



**REPORT ON NUCLEAR AND RADIATION SAFETY IN
UKRAINE FOR 2018**

Kyiv 2019

Dear Readers!



Nuclear and radiation safety has always been important for Ukraine since 15 NPP units are in operation in the country, Chernobyl NPP decommissioning and Shelter transformation into an environmentally safe system are underway, and there are a number of facilities for the management of spent nuclear fuel and radioactive waste and radiation sources. Radiation technologies are used in industry, medicine, science, etc. Therefore, the main tasks of the State Nuclear Regulatory Inspectorate of Ukraine are to promote nuclear and radiation safety not only of nuclear power plants but also of other facilities to ensure that they are safe and do not pose a threat to the public and the

environment.

The year of 2018 was full of events and achievements. At the very beginning of the year, Ukraine officially informed the IAEA Secretariat on joining the countries that committed themselves to complying with the Guidance on the Management of Disused Radioactive Sources.

Ukraine, like most countries of the European Union, is implementing the strategy to justify long-term operation of NPPs whose design life has expired or is going to expire in the near future.

Nuclear power plants are an important component in the country's fuel and energy system. SNRIU continuously supervises the implementation of measures under the Comprehensive (Integrated) Safety Improvement Program for Ukrainian NPPs. In 2018, the SNRIU Board made decisions to extend the lifetime of Rivne NPP Unit 3 and Zaporizhzhya NPP Unit 4 based on the periodic safety review.

An important event was also presentation of the National Report of Ukraine on implementation of obligations under the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management at the Sixth Review Meeting between the Parties to the Convention that was held in Vienna at the IAEA headquarters. Progress was presented in the implementation of measures ensuring an appropriate level of nuclear and radiation safety in the management of spent nuclear fuel and radioactive waste, as required by the Joint Convention.

SNRIU implemented the priority tasks established by decrees and ordinances of the President of Ukraine, resolutions of the Government of Ukraine and decisions of the National Security and Defense Council of Ukraine to ensure nuclear and radiation safety and security, including measures under the Action Plan for the implementation of the Association Agreement between Ukraine of the one part and the European Union, the European Atomic Energy Community and their Member States of the other part for 2014-2018, the Action Plan for the implementation of the Strategy on reforming the state management in Ukraine for

2016 - 2020, the medium-term plan of priority actions of the Government until 2020 and the plan of priority actions of the Government for 2018.

The existing cooperation projects with the regulatory bodies of Sweden, Norway, the United States of America and other partner countries were implemented during 2018, including cooperation projects with the European Commission in the framework of the Instrument for Nuclear Safety Cooperation (INSC), projects of the IAEA Technical Cooperation Program and other programs under the auspices of the organization. Bilateral and multilateral agreements and the memorandum were signed.

In 2018, SNRIU staff faced new challenges and tasks, which are set forth in more detail in the Report.

Sincerely Yours

Chairman of the State Nuclear Regulatory Inspectorate of Ukraine

Hryhorii Plachkov

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ON STATE NUCLEAR REGULATORY INSPECTORATE OF UKRAINE

On 24 May 1991, the State Nuclear Energy Safety Committee of the Ukrainian Soviet Republic (USR) was established in accordance with Resolution No. 12 of the USR Cabinet of Ministers.

On 3 February 1992, the USR State Nuclear Energy Safety Committee was transformed into the State Nuclear and Radiation Safety Committee of Ukraine in accordance with Resolution No. 52 of the Cabinet of Ministers “On Establishment of the State Nuclear and Radiation Safety Committee of Ukraine”. The Chief State Nuclear Safety Inspectorate was set up within the Committee. The Committee as an independent body was liquidated in December 1994.

On 15 December 1994, the Ministry for Environmental Protection and Nuclear Safety of Ukraine was established in accordance with Presidential Decree No. 768/94 to replace the Ministry for Environmental Protection of Ukraine and the State Nuclear and Radiation Safety Committee of Ukraine. The Nuclear Regulatory Administration (NRA) and the Chief State Nuclear and Radiation Safety Inspectorate of Ukraine were established as part of this Ministry (*the state nuclear and radiation safety regulatory body lost its independent status*).

On 13 March 1999, the State Nuclear Regulatory Administration of Ukraine was established by Presidential Decree No. 250/99 and was subordinated to the Ministry for Environmental Protection and Nuclear Safety of Ukraine.

On 15 December 1999, the Ministry for Environment and Natural Resources of Ukraine was established in accordance with Presidential Decree No. 1573/99 to replace the Ministry for Environmental Protection and Nuclear Safety of Ukraine, Committee of Ukraine on Geology and Subsoil Use, Committee of Ukraine on Hydrometeorology, **State Nuclear Regulatory Administration of Ukraine**, Chief Directorate for Geodesy, Cartography and Cadaster and State Commission for Testing and Registration of Plant Protection Products and Growth Regulators and Fertilizers that were liquidated.

The State Nuclear Regulatory Committee of Ukraine was established as a central executive body with special status to improve the state regulation of nuclear and radiation safety in accordance with Presidential Decree No. 1303/2000 of **5 December 2000**. The State Nuclear Regulatory Committee of Ukraine was renamed into the State Nuclear Regulatory Inspectorate of Ukraine within optimizing the system of central executive bodies in accordance with Presidential Decree No. 1085/2010 of **9 December 2010**.

The main functions of the State Nuclear Regulatory Inspectorate of Ukraine (SNRIU) related to the regulation of nuclear energy safety are to:

- determine the criteria, requirements and conditions for the safe use of nuclear energy (**rule-making**);
- issue permits and licenses for activities in this area based on documents submitted the licensee to confirm that its activities comply with safety requirements (**safety assessment and licensing**);
- implement the state oversight of compliance with nuclear and radiation safety laws, regulations, rules and standards and take enforcement actions envisaged by legislation in case of incompliance (**oversight and enforcement**).

SNRIU also implements priority tasks established by decrees and ordinances of the President of Ukraine, resolutions of the Government of Ukraine and decisions of the National Security and Defense Council of Ukraine to ensure nuclear and radiation safety and security, including measures under the Action Plan for the implementation of the Association Agreement between Ukraine of the one part and the European Union, the European Atomic

Energy Community and their Member States of the other part for 2014-2018, the Action Plan for the implementation of the Strategy on reforming the state management in Ukraine for 2016 - 2020, the medium-term plan of priority actions of the Government until 2020 and the plan of priority actions of the Government for 2018.

SNRIU powers extend to the entire territory of Ukraine and regulatory functions are performed directly by SNRIU and through the territorial bodies set up in accordance with the established procedure.

SNRIU currently faces the strategic tasks and objectives related to the state regulation of measures intended to:

- 1) Improve operational safety of NPPs and ensure their long-term operation.
- 2) Enhance energy independence through the construction of new nuclear facilities and the use of new nuclear fuel.
- 3) Ensure ChNPP decommissioning and transformation of the Shelter into an environmentally safe system.
- 4) Improve safety in the production and use of radiation sources, radwaste management, transport of radioactive materials, uranium ore processing.
- 5) Ensure nuclear security.
- 6) Ensure compliance with the obligations of Ukraine related to nuclear weapon nonproliferation.
- 7) Improve and develop the regulatory framework for nuclear and radiation safety.

YEAR 2018 IN DETAILS

Date	Month/event
	<i>January</i>
	<i>February</i>
	Ukraine officially informed the IAEA Secretariat on joining the countries that committed themselves to complying with the provisions of the Guidance on the Management of Disused Radioactive Sources
07	The draft Law “On Amending Certain Laws of Ukraine on Safe Nuclear Energy Use” (reg. No. 7471) was considered at the meeting of the Verkhovna Rada Committee for Fuel and Energy System, Nuclear Policy and Nuclear Safety
12	Bilateral consultations were held in Kyiv to discuss the current state and prospects for cooperation between the SNRIU and Swedish Radiation Safety Authority (SSM)
15	Based on review and discussion of the main results of nuclear and radiation safety regulation for 2017 and priority areas for 2018, the SNRIU Board provided the following according to Protocol Resolution No. 01 of 15 February 2017: <ul style="list-style-type: none"> - recognized the activities of the State Nuclear Regulatory Inspectorate of Ukraine aimed at the implementation of priority tasks set for 2017 as appropriate; - approved the Report on Activities of the State Nuclear Regulatory Inspectorate of Ukraine for 2017 and priority areas for 2018
	<i>March</i>
13-15	The delegation of Ukraine headed by SNRIU Chairman H. Plachkov took part in the 30 th annual Regulatory Information Conference of the U.S. Nuclear Regulatory Commission, which was held in Washington (USA)
13	An agreement was signed between the State Nuclear Regulatory Inspectorate of Ukraine and the U.S. Nuclear Regulatory Commission on technical information exchange and cooperation in the field of nuclear safety
15-16	SNRIU experts took part in joint antiterrorist command-and-staff exercises at South Ukraine NPP that was held with logistic support of the Defense Threat Reduction Agency (DTRA) of the U.S. Department of Defense
30	The following topics were discussed at the SNRIU meeting: <ul style="list-style-type: none"> - efficient use of operating experience (investigation of NPP operational events and deviations and calculation of safety performance indicators for 2017); - status of activities aimed at long-term operation of Zaporizhzhya NPP Unit 4. Upon discussion of the above topics, Resolutions of SNRIU Board No. 02 and No. 03 approved the following decisions: <ul style="list-style-type: none"> - draw Energoatom’s attention to the insufficient quality in investigation of operational events at Ukrainian NPPs and propose to develop a detailed plan of measures to prevent the occurrence of NPP operational events; - operate Zaporizhzhya NPP Unit 4 in shutdown state with fuel fully unloaded from the core to the spent fuel pool for the period when the operating organization takes necessary administrative and technical measures to ensure its long-term operation and determine conditions for renewing the operation of this unit at full power levels
	<i>April</i>

03	SNRIU Order No. 140 approved the regulatory act “Rules for the Construction and Safe Operation of Confining Safety Systems”, which was registered in the Ministry of Justice of Ukraine on 27 April 2018 under No. 534/31986
04	The Committee for Corruption Prevention and Counteraction revised the draft Law “On Amending Certain Laws of Ukraine on Safe Nuclear Energy Use” (reg. No. 7471)
17-18	SNRIU experts took part in joint antiterrorism tactical exercises arranged under project of the Defense Threat Reduction Agency (DTRA) of the U.S. Department of Defense “Integrated Exercise and Training on Preparedness and Response” to check the efficiency of the facility-level interaction plan in case of sabotage and antiterrorist protection at Zaporizhzhya NPP
18-19	SNRIU arranged the next meeting of the Working Group on Development of Reference Levels for Research Reactors (WGRR) of the Western European Nuclear Regulators Association (WENRA) that was held in Kyiv
17	The Verkhovna Rada of Ukraine considered the draft Laws “On Amending Certain Laws of Ukraine in Nuclear Energy Use” (reg. No. 5550) and “On Amending Certain Laws of Ukraine on Safe Nuclear Energy Use” (Reg. No. 7471) at the plenary meeting and, upon review, these drafts were submitted for revision to the Verkhovna Rada Committee for Fuel and Energy System, Nuclear Policy and Nuclear Safety
24-25	A coordination meeting was held at SNRIU to discuss the implementation of bilateral cooperation projects with the Norwegian Radiation Protection Authority (NRPA) in the field of nuclear and radiation safety
23-26	SNRIU experts took part in joint antiterrorist tactical exercises arranged under project of the Defense Threat Reduction Agency (DTRA) of the U.S. Department of Defense “Integrated Exercise and Training on Preparedness and Response” to check the efficiency of the facility-level interaction plan in case of sabotage and antiterrorist protection at Rivne and Khmelnytsky NPPs
25-26	SNRIU Chairman took part in the spring plenary meeting of the Western European Nuclear Regulators Association WENRA (Ghent, Belgium)
26	A national interdepartmental workshop on the topic “Strengthening Emergency Preparedness and Response in Ukraine” was held in Kyiv with support of the Norwegian Radiation Protection Authority (NRPA)
	<i>May</i>
11	License No. EO 001065 for the construction of a radwaste disposal facility (construction of facility No. 21A, Buryakivka RWDS) was issued to the Central Radioactive Waste Management Enterprise
11	The National Report of Ukraine on the implementation of Ukraine’s obligations under the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management was presented at the Sixth Review Meeting of the Parties to the Convention
14	The Cabinet of Ministers of Ukraine submitted to the Verkhovna Rada of Ukraine the draft Law on amending the Law of Ukraine “On Licensing Activities in Nuclear Energy” (reg. No. 8348) developed by SNRIU.
14-17	SNRIU arranged the IAEA Regional Workshop “Communication for Safety”
14-18	The Ukrainian delegation took part in the workshop to discuss the results of the first topical peer review of the National Reports on Aging Management in the EU, Norway, Switzerland and Ukraine (Luxembourg, Grand Duchy of Luxembourg)
14-18	SNRIU experts took part in activities of the IAEA Integrated Mission on the Programme of Action for Cancer Therapy (PACT) (ImpACT) (Kyiv)
21	The Verkhovna Rada Committee for Fuel and Energy System, Nuclear Policy and Nuclear Safety submitted to the Verkhovna Rada of Ukraine the draft Laws “On

	Amending Certain Laws of Ukraine in Nuclear Energy Use” (reg. No. 5550-d) and “On Amending Certain Laws of Ukraine on Safe Nuclear Energy Use” (reg. No. 7471-d) revised with the participation of SNRIU
21.05-01.06	The delegation of Ukraine took part in the Sixth Review Meeting to discuss the implementation of obligations under the Joint Convention on the Safety of Spent Nuclear Fuel Management and on the Safety of Radioactive Waste Management
	<i>June</i>
05-08	SNRIU arranged the next meeting of the Reactor Harmonization Working Group (RHWG) of the Western European Nuclear Regulators Association WENRA, which was held in Kyiv
12	Kyiv hosted the annual meeting of the Ukraine–IAEA Safeguards Implementation Review Group (SIRG)
19-20	The SNRIU delegation took part in the 25th annual forum of regulatory authorities of the countries operating nuclear power plants with WWER-type reactors (WWER Forum), which was held in the city of Ostrovets (Republic of Belarus)
25	SNRIU Order No. 265 approved amendments to the regulation “Requirements for Seismic Design and Seismic Safety Assessment of Nuclear Power Plants”, which was registered in the Ministry of Justice of Ukraine on 12 April 2018 under No. 813/32265
26	SNRIU experts took part in the emergency exercises at South Ukraine NPP with full activation of the emergency and information center
	<i>July</i>
03	SNRIU held public hearings in Varash, the satellite city of Rivne NPP, regarding long-term operation of Rivne NPP Unit 3
04	Draft Law of Ukraine “On Amending the Law of Ukraine on Licensing Activities in Nuclear Energy” (Reg. No. 8348) was considered at a meeting of the Verkhovna Rada Committee for Fuel and Energy System, Nuclear Policy and Nuclear Safety
16	The topic “long-term operation of Rivne NPP Unit 3 based on the periodic safety review” was discussed at the SNRIU Board meeting. Upon discussion of the above topic, the SNRIU Board approved a decision to approve conclusions of the state review on nuclear and radiation safety of the periodic safety review report for Rivne NPP Unit 3 and justification of safe operation of this unit at power levels defined in the design until 11 December 2037
19	The Government Office for the Coordination of European and Euro-Atlantic Integration in the Secretariat of the Cabinet of Ministers of Ukraine approved the translation of Council Directive 2013/59/Euratom of 5 December 2013 laying down basic safety standards for protection against the dangers arising from exposure to radiation and repealing Directives 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom into the Ukrainian language
20	Joint Order of SNRIU and the Ministry of Health of Ukraine “On Establishment of the Interdepartmental Expert Workgroup for Radiation Protection in Medicine” No. 297/1347 of 20 July 2018 approved the composition of the interdepartmental expert workgroup for radiation protection in medicine
23	License No. OB 000893 issued to Odesa SISP for radioactive waste processing and storage was extended (for 5 years)
	<i>August</i>
09	The following topics were considered at the SNRIU Board meeting: <ul style="list-style-type: none"> - implementation of SNRIU Board decisions and resolutions on nuclear safety; - control and accounting of individual doses of occupational exposure of state inspectors and individuals assigned to category A. Upon discussion of the above topics, Resolutions of SNRIU Board No. 06 and No. 07 approved the following decisions:

	<ul style="list-style-type: none"> - draw Energoatom’s attention to a significant increase in the number of NPP operational events that occurred during the first seven months in 2018 and propose to perform a general system analysis of operational events and deviations since 2008 considering all the factors that influenced these events. In addition, the SNRIU Nuclear Installation Safety Department was instructed to develop the first revision of amended NP 306.2.100-2004 “Provisions on the Procedure for Investigation and Accounting of NPP Operational Events” by 31 December 2019, approve and put in force the documents developed to ensure operation of the Integrated NPP Safety Oversight System; - consider the Concept for the Development and Operation of the Unified State System for Control and Accounting of Individual Doses and the National Dose Registry developed by the State Scientific Center of Radiation Medicine of the National Academy of Medical Sciences of Ukraine as a roadmap for further actions in the development of the IDC system of occupational exposure in the country; Radiation Safety Directorate and the Legal Support Administrations were also instructed to complete the development of the draft Resolution of the Cabinet of Ministers of Ukraine “On Approval of the Procedure for Creating the Unified State System for Control and Accounting of Individual Occupational Exposure Doses” harmonized with the EU legislation and international standards, and ensure its acceptance in accordance with legislation
13	Regulation “General Safety Provisions for Radioactive Waste Disposal” was approved by SNRIU Order No. 331 of 13 August 2018 and was registered in the Ministry of Justice of Ukraine under No. 1008/32460 on 5 September 2018
	<i>September</i>
04-09	The SNRIU delegation took part in the meeting related to the implementation of the technical support project in Ukraine for maintenance optimization of systems important to safety using plant configuration risk management (Chicago, USA)
10-14	The self-assessment of the Ukrainian regulatory requirements for radioactive waste storage for compliance with WENRA reference safety levels was presented and defended at the 41 st meeting of the WENRA Working Group on Waste and Decommissioning
13	License No. OB 000863 issued to NSC KIPT for radwaste processing was extended (for 7 years)
17-21	The Ukrainian delegation participated in the 62 nd session of the IAEA General Conference (Vienna, Austria)
18	An administrative agreement was signed between the State Nuclear Regulatory Inspectorate of Ukraine and the Australian Safeguards and Nonproliferation Office (ASNO) in accordance with the Agreement between the Government of Ukraine and the Government of Australia on cooperation in the field of peaceful nuclear energy use
19	A Memorandum on scientific and technical cooperation in nuclear safety was signed between the State Nuclear Regulatory Inspectorate of Ukraine and its technical support organization, State Enterprise “State Scientific and Technical Center for Nuclear and Radiation Safety”, and the Federal Ministry of the Environment, Nature Conservation and Nuclear Safety of the Federal Republic of Germany and its technical support organization, Gesellschaft für Anlagen- und Reaktorsicherheit (GRS)
19	A working meeting was held in the city of Vienna (Republic of Austria) between SNRIU Chairman H. Plachkov and President of the National Atomic Energy Agency of Poland Andrzej Przybycin regarding experience exchange in nuclear and radiation safety regulation

19	A working meeting was held between SNRIU Chairman H. Plachkov and Chairman of the Hungarian Atomic Energy Authority G. Fichtinger on experience exchange in nuclear and radiation safety regulation
19	The Government Office for the Coordination of European and Euro-Atlantic Integration in the Secretariat of the Cabinet of Ministers of Ukraine approved the translation of Council Directive 2011/70/Euratom of 19 July 2011 on the implementation of the Community framework for responsible and safe management of spent fuel and radioactive waste into the Ukrainian language
24	Spets-Montazh License No. OB 001044 for radioactive waste processing was extended (for 5 years)
25	SNRIU held public hearings in the city of Enerhodar in Zaporizhzhya oblast (the satellite city of Zaporizhzhya NPP) regarding long-term operation of Zaporizhzhya NPP Unit 4
27	Activities of the state enterprises subordinated to SNRIU for 2017 and the 1 st half of 2018 were considered at the SNRIU Board meeting. According to SNRIU Order No. 08, activities of the state enterprises subordinated to SNRIU, namely the State Center for Quality Regulation of Supplies and Services and SSTC NRS, for 2017 and the 1 st half of 2018 were evaluated as good
27-28	With participation of members of the Interdepartmental Working Group, SNRIU took part in the arrangement and conduct of the International Conference “Medical Physics: Current State, Issues, and Development Areas. New Technologies”
	<i>October</i>
01	The regulation “Requirements for the Annual Report on Radiation Safety in Uranium Ore Processing” was approved by SNRIU Order No. 391 of 28 November 2018 and was registered in the Ministry of Justice of Ukraine on 26 December 2018 under No. 1461/32913
02-05	The State Nuclear Regulatory Inspectorate of Ukraine hosted the delegation of the U.S. Nuclear Regulatory Commission (U.S. NRC) headed by Commissioner Stephen Burns
11	SNRIU Board Ordinance No. 09 made the decision on: <ul style="list-style-type: none"> - approval of the conclusions of the state review on nuclear and radiation safety of the periodic safety review report for ZNPP Unit 4; - justification of safe operation of ZNPP Unit 4 at power levels specified in the design; - setting the date for the next periodic safety review of ZNPP Unit 4 on 4 April 2028
15-19	IAEA Technical Officer K. Defran visited Ukraine to discuss the implementation of IAEA national projects for Ukraine and cooperation prospects for 2020-2021
17	SNRIU experts took part in special facility-level training at the Nuclear Research Institute of the National Academy of Sciences of Ukraine on the topic “Preparedness for Actions upon Instruction of Emergency Administrative Bodies (Civil Defense) of the Institute in Threat of an Accident at WWR-M Research Reactor”
17	Resolution of the Cabinet of Ministers of Ukraine No. 884 approved a new revision of the Technical Regulation on packaging for radioactive waste storage and disposal
18	Draft Law “On Amending Certain Laws of Ukraine on Nuclear Energy Use” (reg. No. 5550-d) was considered at the meeting of the Verkhovna Rada Committee for European Integration
18-19	SNRIU representatives participated in activities of the Third Forum of Ukrainian Association of Medical Physicists (UAMP)
22	Trilateral Swedish-Norwegian-Ukrainian consultations were held in Oslo, the Kingdom of Norway, to discuss the implementation of projects under the Initiative

23-24	A coordination meeting with representatives of the Norwegian Radiation Protection Authority (NRPA) was held in Oslo (Kingdom of Norway) to discuss the implementation of the existing projects and new prospective cooperation projects
26	SNRIU experts participated in emergency exercises at Zaporizhzhya NPP with complete activation of the emergency information center
29	Chairman of the State Nuclear Regulatory Inspectorate approved recommendations on accounting of small amounts of nuclear material
29-30	The U.S. delegation including representatives of the U.S. Nuclear Regulatory Commission and Brookhaven National Laboratory (BNL) visited SNRIU and SSTC NRS to discuss the implementation of the Memorandum of Meeting between SNRIU and the U.S. Nuclear Regulatory Commission for 2016-2017 and make proposals for its updating
31	Resolution of the Cabinet of Ministers No. 903 amended the Procedure for State Oversight of Compliance with Nuclear and Radiation Safety Requirements
	<i>November</i>
06-08	SNRIU Chairman participated in the autumn plenary meeting of the Western European Nuclear Regulators Association WENRA (Schaffhausen, Switzerland)
12	License No. EO 000953 issued to the Central Radioactive Waste Management Enterprise for operation of radwaste disposal facilities was amended regarding operation of disposal facility No. 21A at Buryakivka RWDS
13	SNRIU experts took part in emergency exercises at Rivne NPP with full activation of the emergency and information center
21	The Verkhovna Rada Committee for Corruption Prevention and Counteraction revised the draft Law “On Amending Certain Laws of Ukraine on Safe Nuclear Energy Use” (reg. No. 7471-d)
22	Resolution of SNRIU Board No. 10 approved the decision on: <ul style="list-style-type: none"> - operation of KhNPP Unit 1 in shutdown state with full fuel unloading from the core to the spent fuel pool for the period when the operating organization takes necessary administrative and technical measures to ensure its long-term operation, - establishment of conditions to renew operation of KhNPP Unit 1 at full power levels
28	Resolution of the Cabinet of Ministers No. 995 of 28 November 2018 made amendments to Resolution of the Cabinet of Ministers of Ukraine No. 313 of 2 April 2001 and invalidated some resolutions of the Cabinet of Ministers of Ukraine
29	SNRIU Board Resolution No. 12 approved a decision to extend License No. EO 001018 for the construction and commissioning of the Neutron Source until 1 December 2020.
	<i>December</i>
01	SNRIU Order No. 443 approved the “Requirements for Making Risk-Informed Decisions on Safety of Nuclear Power Plants”, which was registered in the Ministry of Justice of Ukraine under No. 1535/31403 on 19 December 2017
26	SNRIU Order “On Improvement of Regulations Related to Uranium Ore Processing” No. 391 of 1 October 2018 was registered in the Ministry of Justice of Ukraine under No. 1461/32913

1. STATE REGULATION OF NUCLEAR ENERGY USE

In compliance with the requirements of Articles 19-20 of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management and Articles 7-8 of the Convention on Nuclear Safety, Ukraine committed itself to the following:

- establish and maintain a legislative and regulatory framework to govern the safety of nuclear energy use, which envisages applicable national safety requirements and regulations for nuclear and radiation safety; system of licensing for nuclear energy activities; system for prohibition of nuclear energy use without a license; system of appropriate institutional and regulatory control; enforcement of applicable regulations and terms of licenses; clear allocation of responsibilities for bodies involved in different stages of spent fuel and radioactive waste management;
- establish or designate a regulatory body entrusted with implementation of the legislative and regulatory framework and provided with adequate authority, competence and financial and human resources to fulfill its assigned responsibilities;
- take appropriate measures to ensure effective independence of the regulatory functions from other functions.

1.1. Legislative and Rule-Making Activities in Nuclear Energy Use

The Ukrainian legislative framework in the sphere of nuclear energy governs the entire set of relations related to the use of nuclear energy and nuclear and radiation safety.

The fundamental document in this sphere is the Law of Ukraine “On Nuclear Energy Use and Radiation Safety” enforced in 1995, with changes and amendments introduced later. This document sets the priority of human and environmental safety. The law defines nuclear legislation objectives, fundamentals of the state policy in the field of nuclear energy, rights and obligations of citizens in the field of nuclear energy, competences of governmental and management authorities in the field of nuclear energy and radiation safety and governs state regulation of nuclear energy safety.

The document establishes the legal framework for activities related to the use of nuclear energy and legal framework for international obligations of Ukraine, regulates the liability of the operating organization for nuclear damage, establishes the liability for violation of legislation in the sphere of nuclear energy and radiation safety, etc.

The following regulations and laws govern individual aspects of nuclear energy use and nuclear and radiation safety:

- On Radioactive Waste Management;
- On Uranium Ore Mining and Milling;
- On Human Protection against Ionizing Radiation;
- On Physical Protection of Nuclear Facilities, Nuclear Materials, Radioactive Waste and other Radiation Sources;
- On Civil Liability for Nuclear Damage and Its Financial Support;
- On Procedure for Making Decisions on Siting, Design and Construction of Nuclear Installations and Facilities for Management of Radioactive Waste of National Importance.

The Law of Ukraine “On Licensing Activities in Nuclear Energy” occupies a special place in the nuclear regulatory framework, which identifies activities that are subject to licensing, conditions for these activities, licensing procedure and responsibility for incompliance with the requirements of this Law.

In 2018, efforts were continued to improve the procedure for issuing permits for activities in the field of nuclear energy and bring the licensing system into compliance with the Laws of Ukraine “On Administrative Services”, “On Licensing of Economic Activities” and “On Standardization”. After the Cabinet of Ministers of Ukraine called back the draft Law of Ukraine “On Amending Certain Laws of Ukraine in Nuclear Energy Use”, which was registered in Verkhovna Rada of Ukraine on 23 January 2017 under No. 5703, for revision, SNRIU prepared a draft Law of Ukraine “On Amending the Law of Ukraine on Licensing Activities in Nuclear Energy”. On 14 May 2018, the draft Law was registered in the Verkhovna Rada of Ukraine under No. 8348.

In order to fulfill a number of instructions of the Prime Minister of Ukraine in compliance with the appeal of the ambassadors of G7 countries to Ukraine and upon the meeting of the Prime Minister of Ukraine with the ambassadors, the draft Law of Ukraine “On Amending Certain Laws of Ukraine in Nuclear Energy Use Safety” was developed by SNRIU, agreed with interested authorities, approved by the Cabinet of Ministers of Ukraine and submitted to the Verkhovna Rada of Ukraine.

This draft law is intended to prevent the weakening of state regulation of nuclear energy safety in compliance with the goal of such regulation, which is to ensure nuclear and radiation safety in the country.

The draft law was registered in the Verkhovna Rada of Ukraine under No. 7471, considered by the dedicated committee (Verkhovna Rada Committee for Fuel and Energy System, Nuclear Policy and Nuclear Safety) and other related committees of the Verkhovna Rada of Ukraine. The committees supported this draft law and submitted it to the plenary session for consideration. On 17 April 2018, the draft law was considered at a plenary session, and the people’s deputies of Ukraine made a decision to submit it for revision to the dedicated Verkhovna Rada Committee. The draft law revised by the dedicated Committee with participation of SNRIU was registered in the Verkhovna Rada of Ukraine on 21 May 2018 under No. 7471-d.

The national nuclear legislation includes a number of international acts to which Ukraine is a party. First of all, this is the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), to which Ukraine joined in December 1994 as a non-nuclear-weapon state. This is the Vienna Convention on Civil Liability for Nuclear Damage of 1963, which establishes the absolute responsibility of the operator for nuclear damage. The abovementioned Convention was adopted for Ukraine on 12 July 1996.

Ukraine is also guided by the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (26 September 1986), Convention on Early Notification of a Nuclear Accident (30 December 1986), Convention on the Physical Protection of Nuclear Material (5 September 1993), Convention on Nuclear Safety (17 December 1997) and Joint Convention on the Safety of Radioactive Waste Management (20 April 2000).

The nuclear legislation also includes regulatory acts of the Cabinet of Ministers of Ukraine, which establish the mechanism for implementing the provision of laws and the procedure for activities in the field of nuclear energy (without technical aspects).

In 2018, SNRIU, in fulfillment of individual requests and on its own initiative, developed and the Cabinet of Ministers approved the following:

Cabinet Resolution No. 884 dated 17 October 2018 “On Approval of New Revision of the Technical Regulation on Packaging for Radioactive Waste Storage and Disposal”, developed pursuant to Article 20 of the Law of Ukraine “On Technical Regulations and Conformity Assessment” that requires revision of technical regulations every five years, was brought into compliance with the Ukrainian legislation in the field of technical regulation;

Cabinet Resolution No. 903 dated 31 October 2018 on the Procedure for State Oversight of Compliance with Nuclear and Radiation Safety Requirements was amended to revise the criteria for risk assessment in implementation of activities in the field of nuclear energy safety considering the requirements of the “Methodology for Development of Criteria to Assess Risks in Implementation of Economic Activities and Define the Periodicity of Planned Measures of State Oversight (Supervision)”, approved by Cabinet Resolution No. 342 of 10 May 2018, and in compliance with the third to six paragraphs of Part 2 in Article 5 of the Law of Ukraine “On General Principles for State Oversight (Supervision) in the Field of Economic Activities”;

Cabinet Resolution No. 995 dated 28 November 2018 amended Cabinet Resolution No. 313 dated 2 April 2001 and invalidated some other Cabinet resolutions in order to bring the remuneration for state inspectors involved in state oversight of nuclear and radiation safety, including state inspectors involved in oversight of nuclear and radiation safety directly at nuclear facilities, into compliance with the unique principles for the determination of wages and salaries of state officials envisaged by state service legislation.

Nuclear and radiation safety regulations and rules are an important part of nuclear safety legislation. These documents establish criteria, requirements and conditions for safe use of nuclear energy in all associated areas (safety of nuclear installations, particularly NPPs, safety of radioactive waste management facilities, safety of radiation sources, physical protection, safety of radioactive material transport).

The SNRIU regulations are registered in the Ministry of Justice of Ukraine in compliance with the established procedure and officially published and are binding for entities to which these regulations apply.

In 2018, the improvement of regulations in the field of nuclear energy was continued. The following regulations were adopted:

- Rules on Design and Safe Operation of Confinement Safety Systems, approved by SNRIU Order No. 140 dated 3 April 2018 and registered in the Ministry of Justice of Ukraine on 27 April 2018 under No. 534/31986;

- Amendments to the Requirements for Seismic Design and Seismic Safety Assessment of Nuclear Power Plants, approved by SNRIU Order No. 265 dated 25 June 2018 and registered by the Ministry of Justice of Ukraine on 12 July 2018 under No. 813/32265;

- General Safety Provisions for Radioactive Waste Disposal, approved by SNRIU Order No. 331 dated 13 August 2018 and registered by the Ministry of Justice of Ukraine on 5 September 2018 under No. 008/32460;

- Requirements for the Annual Report on Radiation Safety in Uranium Ore Processing, approved by SNRIU Order No. 391 dated 1 October 2018 and registered by the Ministry of Justice of Ukraine on 26 December 2018 under No. 1461/32913.

- Recommendations on Accounting of Small Amounts of Nuclear Material, approved by SNRIU Chairman on 29 October 2018.

In addition, in connection with the Association Agreement signed on 16 September 2014 between the European Union and the European Atomic Energy Community and their Member States of the one part and Ukraine of the other part and ratified by the Verkhovna

Rada of Ukraine and European Parliament, SNRIU intensified the adaptation of Ukrainian legislation to EU legislation in the field of nuclear safety.

The issues related to cooperation of Ukraine and EC in the field of nuclear safety are envisaged by the Agreement in Article 342 and Annex XXVII (nuclear energy section).

SNRIU started implementation of the Directives actually in 2015 in compliance with the decisions made by the Government of Ukraine and continued these efforts during 2015-2017.

In March 2018, the updated implementation plan came in force, which was approved by Cabinet Resolution No. 1106 of 25 October 2017 and envisaged updating of measures set forth in the previous plans of the Government.

SNRIU developed the draft Law “On Amending Certain Laws of Ukraine on Nuclear Energy Use” to implement Council Directive 2013/59/Euratom laying down basic safety standards for protection against the dangers arising from exposure to ionizing radiation and repealing Directives 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom. The draft Law was supported by the Government and submitted to the Verkhovna Rada of Ukraine (reg. number 5550 of 16 December 2016). SNRIU currently follows the review of draft Law No. 5550-d registered on 21 May 2018 in the Verkhovna Rada of Ukraine, which results from revision of draft Law No. 5550. The decision to revise the draft law was made by the Verkhovna Rada of Ukraine upon its review at the plenary meeting held 17 April 2018.

The development of regulations envisaged by the implementation plan is underway. SNRIU interacts with the Ministry of Health of Ukraine to implement joint measures on implementation of Council Directive 2013/59/Euratom. It should also be noted that the provisions of this Directive are also considered in the development of rules and regulations on radiation safety.

In order to implement Council Directive 2006/117/Euratom on supervision and oversight of radioactive waste and spent nuclear fuel transport, the draft Cabinet resolution “On Amending the Procedure for Issuing Permits for International Transport of Radioactive Materials” was developed. The objective of the draft resolution is to define the procedure for agreement of radioactive waste and spent nuclear fuel transport between Ukraine and EU member states. The draft was agreed with interested central executive bodies and is being prepared for submission to the Cabinet of Ministers of Ukraine.

SNRIU also works on the implementation of Council Directive 2014/87/Euratom dated 8 July 2014, which amends the Community framework for nuclear safety of nuclear installations. The abovementioned Directive is not determined in the Agreement as the one to be implemented by Ukraine, but SNRIU considers its provisions in the development of regulations and rules on nuclear safety.

2. SAFETY OF NUCLEAR INSTALLATIONS

2.1. NPP Operational Safety Improvement

The safety is improved by implementing the measures stipulated in the Integrated (Comprehensive) Safety Improvement Program for Nuclear Power Plants (C(I)SIP) approved by Cabinet Resolution No. 1270 dated 12 July 2011 (with amendments).

According to this Cabinet Resolution, the operating organization (Energoatom) develops annual schedules with deadlines for the implementation of comprehensive measures to improve NPP safety and agrees them with the Ministry of Energy and Coal Industry of Ukraine, SNRIU and State Emergency Service of Ukraine (in terms of fire-fighting measures).

The C(I)SIP period of validity is from 2012 to 2020.

C(I)SIP is financed by Energoatom and, since 2015, from EBRD/Euratom loan funds (Resolution of Cabinet of Ministers of Ukraine No. 356 of 20 August 2014).

The total cost of the C(I)SIP is 20 billion UAH (this amount is being revised and the C(I)SIP cost is now approximately 1.7 billion euros).

As of 31 December 2018, SNRIU agreed 769 of the 1295 planned reports on the implementation of C(I)SIP measures.

2.2. NPP Long-Term Operation

In accordance with Article 6 of the Law of Ukraine “On the Procedure for Making Decisions on Siting, Design and Construction of Nuclear Installations and Facilities for Management of Radioactive Waste of National Importance”, the SNRIU makes decisions on long-term operation of nuclear installations and radioactive waste management facilities of national significance based on conclusions of the state review of nuclear and radiation safety of the periodic safety review report by amending the license to operate a nuclear installation or radioactive waste management facility.

During 2018, the SNRIU regulated the safety of measures on long-term operation at Zaporizhzhya NPP Units 4 and 5, Rivne NPP Unit 3, Khmelnytsky NPP Unit 1, and South Ukraine NPP Unit 3.

Information on long-term operation of Rivne NPP Unit 3, Zaporizhzhya NPP Unit 4 and Khmelnytsky NPP Unit 1 is presented in the Chronology of Events.

Long-term operation of Zaporizhzhya NPP Unit 5 and South Ukraine NPP Unit 3 is provided in accordance with relevant programs for preparation of these power units for long-term operation that are agreed with the SNRIU.



Figure __ Discussion of potential long-term operation of Unit 4 at the SNRIU Board meeting of 11 October 2018

Long-term operation of nine of the 15 units was provided as of 31 December 2018 (Table 2.2.1).

NPP	Unit	Reactor type	Design-basis lifetime/long-term operation
ZNPP	1	WWER-1000/V-320	23.12.2015/23.12.2025
	2	WWER-1000/V -320	19.02.2016/19.12.2026
	3	WWER-1000/V -320	05.03.2017/05.03.2027
	4	WWER-1000/V -320	04.04.2018/04.04.2028
	5	WWER-1000/V -320	27.05.2020
	6	WWER-1000/V -320	21.10.2026
SUNPP	1	WWER-1000/V -302	02.12.2013/02.12.2023
	2	WWER-1000/V -338	12.05.2015/31.12.2025
	3	WWER-1000/V -320	10.02.2020
RNPP	1	WWER-1000/V -213	22.12.2010/22.12.2030
	2	WWER-1000/V -213	22.12.2011/22.12.2031
	3	WWER-1000/V -320	11.12.2017/11.12.2037
	4	WWER-1000/V -320	07.06.2035
KhNPP	1	WWER-1000/V -320	13.12.2018 *
	2	WWER-1000/V -320	07.09.2035

* KhNPP Unit 1 is currently in shutdown state with fuel fully unloaded from the reactor core to the SFP for the period of necessary administrative and technical measures taken by the operating organization to enable its long-term operation. The outage period is up to 6 August 2019.

2.3. Enhancement of Energy Independence through Construction of New Nuclear Facilities and Use of New Nuclear Fuel

A number of new nuclear facilities are currently under construction in Ukraine. In particular:

- 1) Chornobyl ISF-2 is a dry interim storage facility designed for long-term (within 100 years) storage of all nuclear fuel from the Chornobyl NPP;

- 2) CSFSF is a centralized dry spent fuel storage facility for long-term storage of nuclear fuel from the Rivne, Khmelnytsky, and South Ukraine NPPs (within 100 years);
- 3) The neutron source is a nuclear subcritical facility based on a subcritical assembly driven by a linear electron accelerator;
- 4) Khmelnytsky NPP Units 3 and 4.

Construction and commissioning of ChNPP ISF-2

ISF-2 is constructed and put into operation according to SNRIU License EO No. 001002 for construction and commissioning of the nuclear facility (spent fuel storage facility (ISF-2)) of 20 February 2013.



Spent fuel processing facility (ISF-2 SFPF)



Fuel cartridge



Table for damaged fuel management



Acceptance of a double-walled dry shielded canister at ISF-2 site. Storage area is on the left in the background

The SNRIU performed the following according to the ISF-2 Licensing Plan as of 31 December 2018:

1. Preliminary agreement of:
 - **7** technical specifications (TS) for systems important to safety out of the **7** TS developed according to the design;
 - **41** TS for equipment important to safety out of the **41** TS developed according to the design and one TS for equipment with undefined impact on safety (table for damaged fuel management).
2. Agreement of **33** testing programs for equipment important to safety out of the **33** planned programs (factory acceptance tests are not envisaged for 8 units of equipment and individual acceptance tests will be performed at ISF-2 site instead of them) and participation of SNRIU representatives in these tests.
3. Final agreement of **22** TS for equipment important to safety out of the **41** TS developed according to the design.
4. Agreement of **12** programs for comprehensive testing of systems important to safety and process systems out of the 12 programs envisaged in the design.
5. Two ChNPP procedures (out of the four procedures required for ISF-2 commissioning);
6. Technical decision “On Installation of a Crane Truck with a Winch and Grabs in Room 603 of ISF-2 SFPP” (*this technical decision is aimed at eliminating the so-called “dead zones” revealed during the crane tests in room 501 “hot cell” on 7 October 2017, which were the main cause of ISF-2 commissioning delay.*)



ISF-2 concrete storage modules

CSFSF construction and commissioning

The activities under the CSFSF construction project are performed in accordance with the conditions of License EO No. 001060 for construction and commissioning of the centralized spent nuclear fuel storage facility (CSFSF) issued by the SNRIU on 29 June 2017.

During 2018, the SNRIU continued the state review on nuclear and radiation safety and agreement of the technical specifications (TS) and design documents for the systems and equipment important to CSFSF safety as well as NPP upgrade projects within preparation for spent nuclear fuel unloading using Holtec International equipment in accordance with the established procedure.



Activities at CSFSF construction site

The SNRIU provided the following according to the CSFSF Licensing Plan as of 31 December 2018:

1. Preliminary agreement of **15** TS for equipment important to safety out of the 16 TS developed according to the design.

2. Agreement of **14** testing programs for equipment important to safety out of the 16 TS developed according to the design.

3. Final agreement of **5** TS for equipment important to safety out of the 16 TS developed according to the design.

4. Approval of the conclusions of state review on nuclear and radiation safety of the upgrade projects for:

- Rivne NPP Units 1 and 2;

- Rivne NPP Units 3 and 4;
- Khmel'nitsky NPP Units 1 and 2.

Construction and commissioning of the neutron source based on a subcritical assembly driven by a linear accelerator

This nuclear installation is constructed on the territory of the National Scientific Center “Kharkiv Institute of Physics and Technology” (NSC KIPT) in accordance with License EO No. 001018 for the construction and commissioning of the neutron source issued by the SNRIU to the operating organization on 10 October 2013.



Neutron source building

According to the conditions of the above license, NSC KIPT as an operating organization carried out the construction and installation activities during 2013-2018 and developed technical specifications for equipment important to safety and operational documents for the neutron source and agreed them with the SNRIU.



Neutron source

The SNRIU provided the following during 2018:

- agreed 17 operational and technical documents for the neutron source;
- reviewed six operational and technical documents of NSC KIPT and submitted them back for revision;
- participated in individual and functional tests of seven systems important to safety of the neutron source, as well as comprehensive tests of this facility.

In addition, the operating organization is to obtain three individual permits under the license for the following:

- first delivery of nuclear fuel for the neutron source to the NSC KIPT industrial site;
- neutron source initial subcriticality;
- trial and commercial operation of the neutron source.

On 17 September 2018, the SNRIU received an application from NSC KIPT for obtaining an individual permit for nuclear fuel delivery for the neutron source to the NSC KIPT industrial site.

On 5 November 2018, the application was returned by the SNRIU for revision since the operating organization (NSC KIPT) failed to implement the declared activity, which was revealed upon state review of the application package and inspection.

On 29 November 2018, SNRIU Board Resolution No. 12 extended License EO No. 001018 for the construction and commissioning of the neutron source until 1 December 2020.

Construction of Khmelnytsky NPP Units 3 and 4

On 26 July 2018, Cabinet Resolution No. 579-r approved the revised feasibility study for the construction of Khmelnytsky NPP Units 3 and 4, whose draft was agreed by the SNRIU in November 2017.

No other documents on the construction of Khmelnytsky NPP Units 3 and 4 were submitted to the SNRIU in 2018.

Westinghouse fuel implementation

Trial operation of FA-WR started in 2015 at South Ukraine NPP Unit 3. There are also FA-WR in the cores of South Ukraine NPP Unit 2 and Zaporizhzhya NPP Units 1, 3, 4, 5 within extended trial operation.

No prerequisites for violation of FA-WR safe operation at these power units were revealed in 2018.

After the refueling outage in 2018, the core at South Ukraine NPP Unit 3 was loaded only with FA-WR. Upon operation of this fuel loading over the first year, a decision will be made on potential transfer of FA-WR to commercial operation.

NPP operational events

27 notifications on the events that occurred at Ukrainian NPPs were received and reviewed during the year, including:

- 22 notifications on NPP operational events;
- four notifications on deviations in NPP operation;
- one notification on process faults that occurred with equipment of operating NPPs.

The following Board meetings were held in 2018 to prevent the increase in the number of NPP operational events and improve the quality of their investigation:

- 1) 29 March 2018: “On the efficient use of operating experience (results from investigation of NPP operational events and deviations and calculation of safety performance indicators for 2017)”;
- 2) 9 August 2018: “On the implementation of SNRIU Board decisions and orders on nuclear safety”, including discussion of the following topics:
 - process of operational event investigation and completeness of investigation records;
 - correct and timely classification of operational events depending on their features and consequences;
 - correct determination of root causes of operational events and corrective measures to exclude the recurrence of similar operational events in the future;
 - control over the completeness of corrective measures identified upon investigation and compliance with their implementation deadlines.

The distribution of NPP operational events is presented in Table 2.3.1.

Unit	2013	2014	2015	2016	2017	2018	Total for 6 years	Annual average for 6 years
ZNPP -1	2	0	2	2	1	0	7	1.17
ZNPP -2	0	2	1	1	0	3	7	1.17
ZNPP -3	1	1	1	0	1	0	7	1.17
ZNPP -4	2	0	1	2	2	2	9	1.5
ZNPP -5	0	0	2	0	0	0	2	0.33
ZNPP -6	0	1	1	1	2	2	7	1.17
ZNPP	5	4	8	6	6	7	39	6.5
RNPP -1	1	1	0	0	0	1	3	0.5
RNPP -2	0	1	0	0	0	2	3	0.5
RNPP -3	1	1	0	1	4	0	7	1.17
RNPP -4	0	0	0	0	1	0	1	0.17
RNPP	2	3	0	1	5	3	14	2.33
KhNPP -1	1	2	3	0	0	3	9	1.5
KhNPP -2	1	0	1	0	2	5	9	1.5
KhNPP	2	2	4	0	2	8	18	3
SUNPP -1	0	1	2	0	0	0	3	0.5
SUNPP -2	2	0	0	3	2	1	8	1.33
SUNPP -3	0	0	1	2	1	3	7	1.17
SUNPP	2	1	3	5	3	4	18	3
Total	11	10	15	12	16	22	85	14.83

3. SAFETY IN USE OF RADIATION SOURCES

3.1. Approaches in Safety Regulation of Radiation Sources, Conceptual Changes and Prospective Areas

The SNRIU priority tasks for 2018 were specified in the Action Plan for implementation of the Association Agreement between Ukraine of the one part and the European Union, European Atomic Energy Community and their Member States of the other part, approved by Cabinet Resolution No. 1106 of 25 October 2017 (hereinafter the Plan), particularly as regards further implementation of Council Directive 2013/59/Euratom establishing basic safety standards for protection against the dangers arising from ionizing radiation.

In pursuance of the Plan, the final revision of the “General Radiation Safety Rules for Radiation Sources” was developed, which establishes basic requirements for radiation safety in practices with radiation sources that are not exempt from regulatory control over their entire life cycle (from production or transport to the territory of Ukraine up to transfer to a specialized radioactive waste management enterprise or transport from the territory of Ukraine), applying a graded approach to regulating activities with radiation sources in accordance with their potential hazard and ensuring a systematic approach to establishing radiation safety standards and rules for the use of radiation sources for different purposes that will comply with international safety standards (IAEA), in particular: responsibility for radiation safety, role of the regulatory body, justification of practices and individual activities, radiation protection optimization, limitation of radiation risks for personnel and the public, protection of present and future generations, prevention of radiation accidents with radiation sources, etc.

In addition, the SNRIU started development of the draft law “On Amending the Law of Ukraine on Nuclear Energy Use and Radiation Safety” to implement the practice of advising nuclear entities and radiation protection experts to comply with nuclear and radiation safety legislation.

The SNRIU focuses efforts on the improvement and development of the state regulation system, in particular in the area of licensing activities (licensing, registration) and safe use of radiation sources in accordance with the requirements of EU legislation and international safety standards. In order to optimize state regulation, reduce regulatory pressure on nuclear entities and harmonize the legislation of Ukraine with the provisions of 2013/59/Euratom Directive of 5 December 2013, relevant draft laws were developed for:

exclusion of the following activities from the list of practices related to the use of radiation sources and subjected to licensing: receiving (purchasing) and transferring (selling) such sources, also with the purpose of their supply;

exemption from licensing of activities related to the use of radiation sources that meet the exemption criteria established by the Cabinet of Ministers of Ukraine.

The SNRIU prepared draft laws “On Amending the Law of Ukraine on General Principles for State Oversight (Supervision) in the Field of Economic Activities” to restrict the application of this law to the oversight of compliance with nuclear safety requirements and “On Amending the Law of Ukraine on Licensing of Economic Activities” to exclude the application of the law to the procedure of issuing, reissuing and cancellation of licenses for nuclear energy use and ensure control over compliance with the licensing conditions in this area by radiation source users.

In addition, new revisions of the Licensing Conditions for the use and production of radiation sources to be approved in accordance with the established procedure after the adoption of these draft laws were developed according to the proposed amendments to the SNRIU legislation in 2018.

In 2018, the SNRIU periodically monitored the effectiveness of the regulation: Cabinet Resolution “On Approval of Criteria for Exemption of Radiation Sources from Licensing” No. 1174 of 16 November 2011. The monitoring results indicate that the criteria established in this regulation are an efficient basis for making a list of radiation sources whose use is exempt from licensing.

During 2018, the SNRIU carried out analysis and made a draft list including over 15 types of radiation sources that meet the exemption criteria. In addition, radiation source users efficiently apply Annexes 1 and 2 to the Criteria to determine potential for exemption of radionuclide sources from regulatory control.

Unfortunately, the main international principles of radiation protection of personnel are not fully followed in Ukraine, and the arrangement, monitoring and accounting of occupational exposure doses do not meet current requirements and practices of the European Union.

The efforts to improve the State Register of Radiation Sources and implement a unified state system for accounting and control of individual exposure doses of people who directly work with radiation sources were continued in 2018 in order to enhance radiation safety in using radiation sources, establish state control over dose levels in all exposure situations for the public, predict consequences of planned and emergency exposure and establish the ways to reduce possible radiation risks in all exposure situations. As a result of these activities, the draft Cabinet Resolution “On Some Issues on Accounting of Radiation Sources and Individual Exposure Doses” was developed and submitted for approval to interested central executive bodies.

The development of this draft resolution was needed to optimize exposure doses of about 50,000 people who work directly under exposure to radiation and require constant individual dosimetry monitoring.

In addition, Resolutions of the Cabinet of Ministers of Ukraine “On the Procedure for Establishing the Unified State System for Control and Accounting of Individual Public Exposure Doses” No. 406 of 16 March 1999 and “On Approval of the Procedure for Establishing the Unified State System for Control and Accounting of Individual Public Exposure Doses” No. 379 of 23 April 2003 lost their relevance and application due to the rearranged and reassigned functions of a number of central executive bodies involved into the radiation safety regulation in Ukraine, in particular, pursuant to Cabinet Resolutions “On Optimizing the System of Central Executive Bodies” No. 442 of 10 September 2014 and “Some Issues of the State Health and Epidemiological Service” No. 348 of 29 March 2017.

Since Ukraine has no unified state system for monitoring and accounting of individual public exposure doses, particularly occupational exposure doses, the central executive bodies responsible for nuclear and radiation safety of personnel in accordance with legislation have no instrument to control the safe use of nuclear and radiation technologies and comply with the main radiation protection principles.

The SNRIU constantly monitors the mandatory state registration of radiation sources at the State Enterprise “UDVP Isotope”. Thus, 24,483 radiation sources including 9034 sealed radionuclide sources and 15,449 non-radionuclide installations generating radiation were used in Ukraine in 2018. The quantitative distribution of registered radiation sources according to administrative and territorial units is given in Table 7.1.1.

Table 3.1.1 Distribution of registered radiation sources and their owners according to administrative and territorial units in 2018

Oblasts and other administrative and territorial units in Ukraine	Number			
	radionuclide sources		radiation generators	
	owners	registered radiation sources	owners	registered radiation sources
Vinnitsia	5	16	117	510
Zhytomyr	16	47	101	426
Kyiv	33	1952	141	632
Cherkasy	6	56	89	372
Chernihiv	5	25	73	357
The city of Kyiv	43	328	337	1818
Total in the region of the Northern State Inspectorate	108	2424	858	4115
Dnipropetrovsk	48	1207	238	1223
Kirovohrad	6	38	73	334
Total in the region of the Central State Inspectorate	54	1245	311	1557
Donetsk	50	575	260	1367
Zaporizhzhya	16	575	150	704
Luhansk	19	294	165	679
Total in the region of the South-Eastern State Inspectorate	85	1444	575	2750
Kharkiv	61	1022	251	1427
Poltava	21	343	126	527
Sumy	13	140	161	505
Total in the region of the Eastern State Inspectorate	95	1505	538	2459
Rivne	6	248	115	363
Volyn	9	37	84	304
Khmelnitsky	8	206	86	398
Ternopil	3	7	77	265
Total in the region of the North-Western State Inspectorate	26	498	362	1330
Ivano-Frankivsk	13	73	130	422
Lviv	23	188	181	836
Zakarpattia	4	71	68	329
Chernivtsi	5	14	56	298

Total in the region of the Western State Inspectorate	45	346	435	1885
Odesa	31	1045	152	718
Mykolaiv	9	511	73	344
Kherson	5	16	83	291
Total in the region of the Southern State Inspectorate	45	1572	308	1353
Total	458	9034	3387	15449

In total, 268 radionuclide radiation sources were imported to the territory of Ukraine including 205 sealed radiation sources subjected to state registration in the State Register of Radiation Sources.

The main manufacturers and suppliers of radionuclide sources that were imported to Ukraine in 2018 were enterprises of Poland, Belarus, Germany, the Netherlands, and the United States, in particular: National Centre for Nuclear Research (Radioisotope Centre POLATOM), Belarusian/Russian Closed Joint Stock Company “Isotope Technologies”, Eckert&Zeigler Isotope Products GmbH, Eckert&Zeigler Nuclitec GmbH, Berthold Technologies GmbH & Co.KG, Mallinckrodt Medical BV, etc.

The State Enterprise “UDVP Isotope”, Dystrim Ltd. (former Foreign Economic Trading Firm “Impulse”), Schlumberger Services Ukraine Ltd., ShimUkraine Ltd., UKRIZOTOPSERVIS Ltd. distribute radionuclide sources in Ukraine.

About 43% of radionuclide sources imported to Ukraine fall to the share of the State Enterprise “UDVP Isotope”. Dystrim Ltd. imported 94 fast neutron sources with radionuclide Am-241 and activity of 82 GBq equal to approximately 35% of the imported sources.

The number of radionuclide sources imported in 2018 and their applications are indicated in Table 7.1.2.

Table 3.1.2 Number of radionuclide sources imported in 2018

No.	Radionuclide	Application	Number of radiation sources	
			units	% (of imported ones)
1	Am-241	Radioisotope control devices (including 94 boron concentration monitoring systems for NPPs)	96	35.82
2	Co-60	Gamma therapy, radioisotope control devices	51	19.03
3	Ir-192	Gamma therapy, gamma radiography	43	16.04
4	Cs-137	Radioisotope control devices for technological processes	18	6.72
5	Eu-152	Standard and calibration research	9	3.36
6	Cf-252	Radioisotope control devices for technological processes	6	2.24

7	H-3	Geophysical survey tools	6	2.24
8	Ni-63	Detectors of explosives and drugs, chromatography	5	1.87
9	Other		34	12.68

250 X-ray devices for different purposes were imported to Ukraine in 2018.

According to the application, the imported radiation sources are structurally divided as follows: approximately 73.9% for the use in industry, border and other controls; approximately 24.3% for medical purposes and for veterinary medicine; and about 1.8% for other purposes.

The main enterprises that use radiation sources received within direct contracts with foreign manufacturers or suppliers are: nuclear power plants, health care facilities, mining and processing plants, enterprises for the production of cement and cardboard and paper enterprises, enterprises producing geophysical surveys, etc.

The radiopharmaceuticals that were supplied to health care institutions in 2018 included I-131, I-125, Sr-89 and Sm-153 radionuclides with a total activity of 8,459,656 MBq for I-131, 2,380,977.809 MBq for I-125, 16,050 MBq for Sr-89 and 262,180 MBq for Sm-153.

Radionuclide sources were not produced in 2018; information on the production of generating devices is given in Table 7.1.3.

Table 3.1.3. Generating devices manufactured in Ukraine in 2018

Producer	Type of produced generator	produced (pcs.)	including	
			for Ukraine	exported abroad
CJSC Kiev Production Association "Medaparatura"	RDK-VSM X-ray diagnostic system with digital image processing	7	5	2
	Fluorography with digital image processing	3	1	2
X-ray Equipment Plant "Kvant"	KRD-50 INDIagraf X-ray diagnostic system	5	5	–
	INDIascan X-ray diagnostic system	3	3	–
	INDIascop X-ray diagnostic system	1	1	–
RADMIR Company	MADIS x-ray mammography digital systems	23	4	19
	SIMA x-ray mammography digital systems	6	3	3
Scientific Production Company KRAS	ASPECT digital X-Ray equipment	1	1	–
	MEDICS X-ray diagnostic system	7	7	–

Teleoptik Ltd.	KRDTs X-ray diagnostic digital system	1	1	–
Elvatech Ltd.	Series 01 and 02 Energy X-ray spectrometer	227	21	206
RPE Institute of Analytic Control Methods, LLC	Expert 4L X-ray fluorescent elemental analyzers of alloys	6	6	–
	Expert Mobile X-ray fluorescent elemental analyzers of alloys	2	1	1
Total		292	59	233

551 sources (120 sealed radionuclide sources and 431 non-radionuclide devices) were removed from the register in 2018.

3.2. State Safety Regulation of Radiation Sources in Medicine

Medicine is the largest application of radiation sources in Ukraine.

Up to 40% of licensees on nuclear energy use are issued to healthcare institutions of different ownership.

Radiation sources with a high potential hazard level (categories 1-2), constituting about 70% of the total number, are mostly used in medical industry.

According to the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), medical exposure in the total collective dose of the public in different countries ranges from 60 to 90%.

The use of radiation sources in medicine requires coordinated and skilled work of highly qualified medical personnel, such as doctors, medical physicists, and engineers, and guaranteed equipment quality. The failure to ensure appropriate conditions and optimize dose planning, technical failures of equipment, and failure to follow safety regulations by personnel may cause radiation injuries to patients.

59 cases of radiation injuries to patients that resulted from the above causes were registered within the last five years in Ukraine according to the S.P. Grigoriev Institute for Medical Radiology of the National Academy of Medical Sciences of Ukraine.

However, unjustified medical exposure can be prevented by complying with the established recommended boundary exposure limits in medical imaging and diagnostic reference levels; improving the quality control of diagnostic and therapeutic procedures; improving the quality in the use of advanced methods and tools of diagnostic and therapeutic radiation; advanced training of personnel performing diagnostic and therapeutic procedures, etc.

Considering that the use of radiation sources in medicine is closely related to human beings and can cause higher doses than in other applications, the development and implementation of regulations, rules and standards for radiation safety in using radiation sources in medicine and strengthening the state regulation in this area are among the SNRIU's priorities.

The state policy and national legislation on nuclear and radiation safety in medicine are developed and implemented considering international safety standards and European legislation.

At present, the SNRIU's priority task is to bring the regulatory system for nuclear and radiation safety into compliance with 2013/59/EURATOM Council Directive of 5 December 2013 establishing basic safety standards for protection against the dangers arising from exposure to ionizing radiation and IAEA "Radiation Protection and Safety of Radiation Sources" (International Basic Safety Standards, IAEA, 2014).

A significant step towards increasing the level of radiation protection in medicine in 2018 was the establishment of the Interdepartmental Working Group of Experts on Radiation Protection in Medicine. The members and statute of the group were approved by a joint order of the SNRIU and the Ministry of Health of Ukraine. The Interdepartmental Group included representatives of the SNRIU, Ministry of Health of Ukraine, National Academy of Medical Sciences of Ukraine, state medical research institutes, professional medical public organizations and healthcare institutions of different ownership (information on activities of the Interdepartmental Working Group is constantly updated on the UATOM website on nuclear safety, radiation protection and non-proliferation of nuclear weapons (<https://uatom.org>, Radiation Safety in Medicine).

The main tasks of the Interdepartmental Working Group are to provide independent recommendations on radiation protection in medicine, develop an Action Plan and a mechanism for the implementation of the roadmap, which is the Action Plan to improve the radiation protection of personnel and patients in use of radiation sources in medicine, develop measures to improve the radiation protection system in using radiation sources for diagnostics and treatment, and monitor the implementation of these measures and the "roadmap".

Considering recommendations and decisions of the Interdepartmental Group, the SNRIU strengthened the state oversight of quality control in radiation therapy procedures, particularly calibration of X-rays in remote radiation therapy devices (gamma-therapeutic devices and linear accelerators) in 2018. The implementation of the IAEA international protocol "Absorbed Dose Determination in External Beam Radiotherapy: An International Code of Practice for Dosimetry based on Standards of Absorbed Dose to Water (TRS-398)" was started to introduce a common approach to determine the absorbed dose during remote radiation therapy and significantly improve the accuracy of equipment calibration.

The SNRIU inspected 15 cancer treatment centers in 2018.

A roadmap was developed to implement international safety requirements (IAEA), EU legislation, national legislation on the safety of medical exposure and "Provisions on the Arrangement and Conduct of National Thermoluminescent Dosimetry Audit of X-Ray Calibration Quality in Radiation Therapy Devices" developed by the S.P. Grigoriev Institute for Medical Radiology were approved.

In order to implement the National Action Plan under IAEA RER9147 Project "Enhancing Member States' Capabilities for Ensuring Radiation Protection of Individuals Undergoing Medical Exposure" with participation of members of the Intergovernmental Working Group:

draft methodological recommendations to assess effective and equivalent doses for different types of diagnostic examination were developed;

development of the radiation therapy planning system and 3D printing technology to manufacture dosimetry anthropomorphic phantoms was started;

proposals were developed to improve the system of education and training in radiation safety in medicine, in particular, software design versions were developed using the Moodle software platform for training in radiation safety;

SAFRON (safety in radiation oncology) and SAFRAD (safety of radiological procedures) updated reporting systems were distributed in health facilities;

International Conference “Medical Physics: Current Status, Issues, Development Areas. New Technologies” was arranged and held to present current IAEA recommendations and reports of leading Ukrainian experts in medical physics on advanced approaches to radiation diagnosis and treatment;

international training workshop on Regulatory Control of Radiation Protection in Medical Applications was held under the nuclear safety training program of the European Nuclear Safety Training and Tutoring Institute (ENSTTI).

In October 2018, SNRIU representatives took part in the Third Forum of the Ukrainian Association of Medical Physicists (UAMP), which was mainly focused on medical physics development in Ukraine. The “round table” participants noted at the Forum that cooperation with professional organizations, healthcare institutions and central executive bodies was a prerequisite to the development of medical physics and, accordingly, radiation safety improvement in medicine.

In addition, to provide professional development of personnel and officials in radiation safety, the SNRIU and its territorial bodies continued to revise and approve relevant training programs that were presented by Ukrainian training centers according to the procedure for radiation safety training and examination of personnel and officials of entities dealing with nuclear energy use, approved by SNRIU Order No. 143 of 2 October 2014 and registered in the Ministry of Justice on 2 December 2014 under No. 1549/26326 (25 training centers are currently operating in Ukraine).

In 2018, expert support was continued to commission new radiation therapy equipment (linear accelerators) and X-ray diagnostic equipment at health care institutions that were supplied in accordance with Cabinet Resolution “On Approval of the Procedure and Conditions for Granting a Subvention from the State Budget to Local Budgets for Purchasing Hagiographic Equipment” No. 185 of 21 February 2017 (health facilities received about 80 units of equipment in 2018).



In 2018, the 92nd IAEA Integrated Mission of the Programme of Action for Cancer Therapy (ImPACT) was conducted in Ukraine (hereinafter the Mission) with support of the Ministry of Health of Ukraine and SNRIU.

The IAEA experts evaluated Ukraine's capabilities in cancer prevention, early detection, diagnosis and treatment, palliative care and public awareness, and radiation safety of patients and personnel during diagnostic and treatment procedures.

According to the results of the IAEA Mission, it is planned to provide Ukraine with assistance in the development of a comprehensive national cancer control program in order to contribute to public access to high-quality and effective cancer treatment.

The SNRIU is aimed at the development of regulations for the safe use of radiation sources in medicine, in particular the safe use of electron accelerators for medical purposes, gamma therapeutic devices for remote exposure, improvement of requirements for the quality control system for diagnostic and therapeutic procedures using radiation sources, high-quality maintenance of medical radiological equipment, implementation of unified approaches for quality assurance in the verification of clinical dosimeters, certification of radiation beams in radiation therapy devices, quality control of X-ray diagnostic equipment, development of unified protocol forms of general quality control standards in X-ray diagnostics, development and implementation of international protocols, as well as development of the concept for medical physics establishment in Ukraine.

4. SAFETY OF URANIUM PLANTS

The SNRIU reviewed four licensing cases relating to uranium ore processing in 2018. Based on the review, one license was issued, one license was amended, one license was renewed and the license issued to the State Enterprise “Barrier” was suspended due to failure to comply with special conditions for uranium ore processing.

The following was reviewed and agreed last year:

- Draft Cabinet Resolution “On Approval of the Concept for the National Target Environmental Program of Priority Measures for Bringing the Facilities and Site of the Former Uranium Production Association “Prydniprovsky Chemical Plant” into Safe State for 2019 - 2023”, submitted by the Ministry of Energy and Coal Industry of Ukraine;

- Draft Cabinet Resolution “On Approval of the Concept for the National Target Environmental Program for Decommissioning of Uranium Plants for 2020-2024”, submitted by the Ministry of Energy and Coal Industry of Ukraine;

- Draft Cabinet Resolution “On Approval of the Concept for the National Target Environmental Program for Radiation and Social Protection of the Public in the Kirovohrad Oblast and the City of Kropyvnytsky”, submitted by the Kirovohrad Regional State Administration.

Nuclear and radiation safety review was performed and a positive conclusion was provided for the working project of the State Enterprise “Eastern Mining and Processing Plant” on “Novokostiantyniv Mine. Reconstruction of the Mine Ventilation System. The Main Radiation Safety Decisions. NK-P1-003-000-00-00-RB”.

Nuclear and radiation safety review is currently underway for:

- project of the State Enterprise “Eastern Mining and Processing Plant” on the “Construction of Enterprise Startup Facilities Based on the Existing Facilities in the Novokostiantyniv Mine. NK-PK-000-000-00-RB-PZ”;

- feasibility study of the industrial complex for trial and commercial development of the Safoniv uranium ore deposit by underground borehole leaching (**the village of Mykolaivka, Kazankiv region, Mykolaiv oblast**).

In 2018, the SNRIU participated in EC Project U4.02/16 A1 “Implementation of the Urgent Measures to Mitigate the Emergency Situation in the Prydniprovsky Chemical Plant in the city of Kamianske (former Dniprodzerzhynsk) in Ukraine”.

5. RADIOACTIVE WASTE MANAGEMENT

5.1. Management of Radioactive Waste in Exclusion Zone

A key element in developing the radioactive waste management system in Ukraine is construction of a series of radioactive waste management facilities in the exclusion zone, including:

- radioactive waste management facilities at the Vektor site intended for the final stage of radwaste management (centralized disposal and long-term storage) of all waste producers in Ukraine, as well as processing of some types of radioactive waste from the exclusion zone and minor waste producers;
- construction of radioactive waste management facilities at the ChNPP site;
- surveys of sites for a geological repository.

According to the Strategy for Radioactive Waste Management¹ and the National Target Environmental Program for Radioactive Waste Management², the primary tasks and measures aimed at developing the radwaste management system in the exclusion zone envisage the following:

- commissioning of near-surface low-level and intermediate level short-lived radwaste disposal facilities of Vektor Stage 1³;
- operation of engineered near-surface radwaste disposal facility (ENSDF⁴) constructed at the Vektor site;
- design and construction of pre-disposal long-term storage facilities (over 30 years) for long-lived high-level radioactive waste in geological repository within Vektor Stage 2⁵ including vitrified radwaste resulting from spent fuel reprocessing to be returned from the Russian Federation, disused radiation sources and other long-lived high-level radioactive waste;
- maintenance of the existing management facilities for Chernobyl-origin radioactive waste constructed during the first years of Chernobyl accident mitigation: Buryakivka RWDS⁶, Pidlisny RWDS⁷, ChNPP Stage III RWDS⁸, and RICS⁹ including their monitoring, upgrade, stabilization, safety improvement, inspection, safety review, remediation;

¹ Approved by Cabinet Resolution No. 990-r of 19 August 2009

² Approved by Law of Ukraine No. 516-VI of 17 September 2008

³ Vektor Stage 1 includes near-surface disposal facilities for low- and intermediate-level short-lived radwaste resulting from the Chernobyl disaster of two types: SRW-1 is a facility for disposal of radioactive waste in reinforced concrete containers, SRW-2 is a module-type disposal facility for unpacked large-size radioactive waste.

⁴ ENSDF was constructed in 2009 under ChNPP ICSRM project for disposal of radioactive waste packages from ChNPP LRTP and SRTP with a capacity of 50 210 m³ for radioactive waste packages, which consists of two parallel sections, each of them has 11 reinforced concrete sections (modules), central drainage gallery and two movable frame structures with bridge cranes.

⁵ Vektor Stage 2 includes long-term storage facilities for long-lived high-level radioactive waste; near-surface disposal facilities for low- and intermediate-level short-lived radioactive waste; treatment plants for Chernobyl radwaste and radwaste generated in non-nuclear sector. The Vektor Stage 2 Feasibility Study was approved by Cabinet Resolution No. 1605-r of 23 December 2009

⁶ Buryakivka RWDS is one of the main components of the management system for large amounts of accident-related radwaste that was constructed in 1987 under the emergency measures aimed at Chernobyl accident mitigation. Buryakivka provides, up to now, the disposal of a large amount of low-level radioactive waste generated during the activities performed at ChNPP site and on the contaminated territories in the exclusion zone.

⁷ Pidlisny RWDS was constructed under the emergency measures aimed at Chernobyl accident mitigation. A-1, B-1 modules in this RWDS in 1986-1988 included the most hazardous high-level long-lived accident-related radioactive waste (fuel-containing materials, radioactive graphite, etc., that were thrown from the reactor during the accident).

⁸ ChNPP Stage III RWDS was constructed under the emergency measures aimed at Chernobyl accident mitigation in uncompleted storage facility for radioactive waste of uncompleted ChNPP Stage 3. The reinforced concrete modules in this facility in 1986-1988 contained low- and intermediate-level accident-related waste. Over the years, there are processes of degradation of the hastily constructed dumping, which requires constant repair and maintenance.

⁹ RICS are territories adjacent to ChNPP with a total area of about 10 hectares on which trenches and pits for radwaste confinement were constructed during the emergency measures aimed at Chernobyl accident mitigation. Such radwaste are mainly building structures, household items, upper layer of the soil, etc., contaminated in emergency release. There were from 800 to 1000 RICS trenches and pits.

- surveys and research & development for siting a geological repository for long-lived high-level radioactive waste.

In order to implement the above activities, the Centralized Radioactive Waste Management Enterprise (CRME) was appointed as the only operating organization at all lifecycle stages of the radioactive waste disposal facilities.

Implementation status

1. Completion of radioactive waste disposal facilities SRW-1 and SRW-2 of Vektor Stage 1 was performed in the exclusion zone during 2018.



SRW-1 disposal facility



SRW-2 disposal facility

2. CRME operates the engineered near-surface disposal facility for low- and intermediate-level short-lived radioactive waste (ENSDF). ENSDF accepted 404 radwaste packages for disposal since operation beginning. Total amount of radwaste is 321.55 m³ with total activity of 1.04E+12 Bq. 148.3 m³ of radioactive waste with total activity of 8.70E+11 Bq was accepted for disposal in 2018.



ENSDF



Radioactive waste package loading into ENSDF section

3. Operation of the centralized long-term storage facility for disused radiation sources (CLTSF) is ongoing, which includes CLTSF comprehensive (hot) tests with disused radiation sources. CLTSF operation includes acceptance, processing (conditioning) of radioactive

waste in form of disused radiation sources of different types and categories and location of packages containing such radwaste according to radiation type for long-term storage during 50 years.

1959 disused radiation sources with total activity of $1.29\text{E}+14$ Bq were accepted for storage since the beginning of CLTSF operation. 271 disused radiation sources with a total activity of $5.83\text{E}+13$ Bq were accepted for storage during 2018.

In order to eliminate safety deficits revealed during hot tests in 2018, CRME provided biological protection in cable penetrations under hot cells in CLTSF and additional inspection of the radiation-protective properties of the hot cells “B” and “C” in accordance with the technical decisions agreed with the SNRIU.



Centralized long-term storage facility for disused radiation sources (CLTSF)



Storage area for disused radiation sources in CLTSF

4. 30 trenches with total amount of radioactive waste of $690,000\text{ m}^3$ and total activity of $2.54\text{E}+15$ were filled and preserved at Buryakivka RWDS.

Additional disposal facility 21A was constructed in 2018 to expand production capacities of Buryakivka RWDS.

5001.5 m^3 of radioactive waste with total activity of $5.58\text{E}+11$ Bq was accepted for disposal since the beginning of operation of disposal facility 21A at Buryakivka RWDS in 2018.



Buryakivka RWDS

6. CRME implements routine maintenance to ensure safety at Pidlisny and ChNPP Stage III RWDS.

CRME conducted field surveys of Pidlisny RWDS module A-1 pursuant to the National Target Environmental Program for Radioactive Waste Management in 2018. The activities were performed in accordance with the Technical Decision on Additional Survey of Pidlisny RWDS and the Program for Study of Radioactive Waste Characteristics in Pidlisny RWDS Module A-1. The survey results are analyzed and processed to assess the safety of radioactive waste storage and safety in further management of such waste.

In the long term, the issue related to retrieval of radwaste from these RWDS and its redispersion in appropriate disposal facilities should be solved. Preparation for radwaste retrieval from these RWDS is part of the long-term measures to be implemented stage by stage after the development of retrieval, handling and disposal technologies for this waste.



Pidlisny RWDS



ChNPP Stage III RWDS

According to CRME technical documents, routine activities were conducted to ensure safety in radioactive waste storage facilities on the territories of radwaste interim confinement sites (RICS): Yaniv Station, Naftobaza, Pischane Plato, Rudy Lis, Stara Budbaza, Nova Budbaza, Prypyat, Kopachi and Chystohalivka.

CRME conducted surveys on Rudy Lis RICS territories (GPS survey, well drilling and soil sampling) to confirm the location of storage places using specified data obtained in



surveys conducted within international industrial project INSC U4.01/10D to implement safety improvement measures for RICS and RWDS in 2018.

7. Construction of a geological repository for radioactive waste is envisaged pursuant to the requirements of the Strategy for Radioactive Waste Management in Ukraine. Task 11 of the “National Target Environmental Program for Radioactive Waste Management” defines measures to

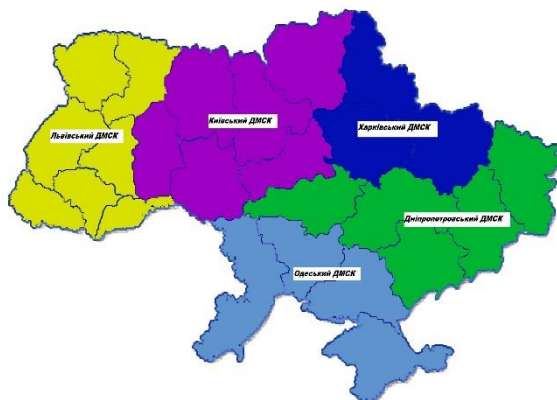
perform survey, assessment, scientific, methodological, research and design activities for siting of a geological repository for long-lived high-level radioactive waste.

INSC U.04.01/14 B Project “Development of a National Plan for the Geological Disposal of Radioactive Waste in Ukraine and Implementation Schedule” was launched under the Instrument for Nuclear Safety Cooperation of the European Commission in 2018. The beneficiary for this project is the State Agency of Ukraine on Exclusion Zone Management and the end user is CRME, the operating organization for radioactive waste disposal facilities. The SNRIU on its part ensures active participation of its representatives in this project.

5.2. Management of Radioactive Waste on Ukrainian Territory

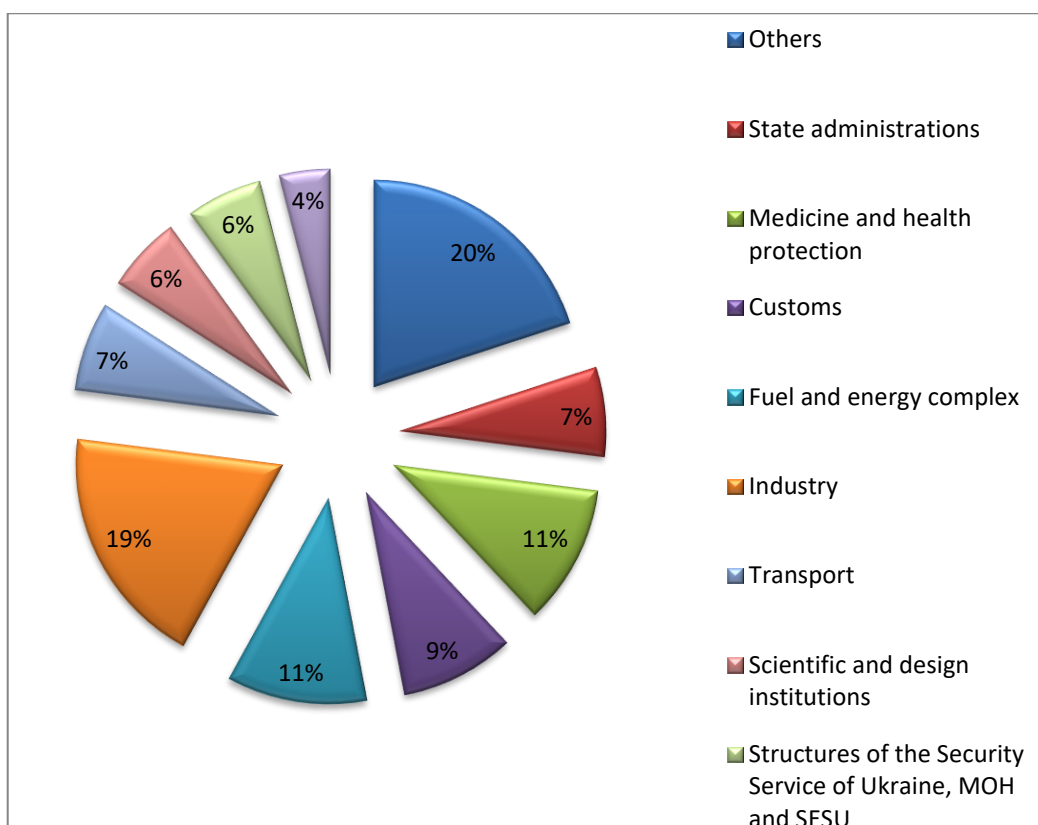
Safe storage or disposal of radiation sources at the end of their lifetime is an important condition for their safe use in order to avoid their loss or access of the public. The reason is that disused radiation sources remain hazardous after expiration of their lifetime as they contain radioactive material that can cause significant damage to human health in case of distribution or inadvertent use.

Disused radiation sources are declared as radioactive waste and become the state property. Their further management is implemented in accordance with the safety requirements for radioactive waste management of the state specialized enterprises on radioactive waste management of the Radon Ukrainian State Corporation (Radon USC).



Kyiv, Kharkiv, Dnipropetrovsk, Lviv, Odessa State Interregional Specialized Plants (SISPs) are currently operated on the Ukrainian territory.

These enterprises, on the territories of their assigned service areas, ensure collection, transport and safe placement of radioactive waste in storage/disposal facilities specially designed for this. At the same time, SISPs operate stations for decontamination of underwear, special clothes and personal protective means of medical and research institutions and enterprises.



Main groups of radioactive waste suppliers to Radon USC SISPs in 2018

This table includes information on radioactive waste supply to Radon SISPs in 2018.

Table 1 Information on radioactive waste supply to Radon SISPs in 2018

Radon SISPs	Solid radwaste		Disused radiation sources in biological shielding	
	Mass, t	Activity, Bq	Number, items	Activity, Bq
Dnipropetrovsk SISP	47.051	1.72E+10	113	3.52E+12
Kyiv SISP	0.043	6.63E+08	934	3.66E+14
Lviv SISP	0.581	4.8E+10	90	1.27E+12
Odesa SISP	0.032	3.12E+08	51	1.15E+08
Kharkiv SISP	75.490	5.86E+08	132	2.07E+12
Total	123.197	6.67E+10	1320	3.73E+14

Since the radioactive waste management facilities at these plants were constructed in the Soviet era in 1960-1970s, the National Program for Radioactive Waste Management provided a number of measures to reequip SISPs. This includes measures to retrieve radioactive waste from old facilities and re-dispose it in the centralized disposal facilities at the Vektor site in the exclusion zone. This will allow liquidation of old radioactive waste disposal facilities that do not meet current safety requirements and mitigation of associated potential hazards of radionuclides spread in the environment. In each case, such decisions should be made upon safety review performed by specialized enterprises in accordance with the conditions of licenses issued by the SNRIU.



Radioactive waste storage in containers in SISP

As of 01 January 2019, Radon USC storage facilities include:

- low- and intermediate-level solid waste of 4396.5 t, (6073.8 m³) with total activity of 1.61E+15;
- low- and intermediate-level liquid waste of 789 m³ with total activity of 1.08E+13;
- radioactive waste in the form of disused radiation sources stored in well-type disposal facilities: 57,811 items with total activity of 3.93 E+14;
- radioactive waste in the form of disused radiation sources stored in solid radioactive waste storage facilities and in containers: 599,705 items with total activity of 2.23E+16.

This is presented in detail in Table 2.

Table 2. Information on radioactive waste amounts in Radon SISP storage/disposal facilities as of 01 January 2019

Radon USC Dnipropet rovsk SISP	Low- and intermediate- level solid radwaste			Low- and intermediate- level liquid radwaste		Disused sealed radiation sources			
						Sealed radiation sources in solid radwaste facilities and containers		Sealed radiation sources in well-type disposal facilities	
	Mass, t	Amo unt, m ³	Activity, Bq	Amo unt, m ³	Activity, Bq	Numbe r, items	Activity, Bq	Activ ity, Bq	Acti vity, Bq
Kyiv SISP	348.5	619.8	5.96E+1 1	124	1.27E+1 0	21235 0	6.35E+1 4	8391	9.85 E+1 3
Lviv SISP	1299. 2	2108. 0	1.58E+1 5	480	1.07E+1 3	15765 3	1.68E+1 5	6609	1.25 E+1 4
Odesa SISP	510.2	699.0	5.34E+1 2	0	0.00E+0 0	96885	2.27E+1 4	8151	3.71 E+1 3

Kharkiv SISP	252.1	525.7	1.57E+1 3	183	1.10E+1 1	38650	1.95E+1 6	1931 2	5.42 E+1 3
Radon USC SISPs	1986. 5	2121. 3	5.45E+1 2	2	7.69E+0 6	94167	2.74E+1 4	1534 8	7.78 E+1 3
Total	4396. 5	6073. 8	1.61E+1 5	789	1.08E+1 3	59970 5	2.23E+1 6	5781 1	3.93 E+1 4

In 2018, radioactive waste in form of disused radiation sources was supplied from CLTSF special plants for hot tests, namely:

- 16 disused radiation sources from Kharkiv SISP
- 159 disused radiation sources from Dnipropetrovsk SISP
- 82 disused radiation sources from Kyiv SISP
- 7 disused radiation sources from Odesa SISP.

Kharkiv SISP also supplied 188.885 tons of radioactive waste with total activity of 2.31E+08 Bq (105 packages) for disposal to ENSDF.

Specialized enterprises are also involved in urgent actions of competent authorities on mitigation of emergencies associated with revealing abandoned radiation sources or illicit trafficking of radiation sources. All these radiation sources are transferred to storage/disposal facilities of specialized enterprises where their safe and controlled storage, as well as localization from entry into the environment and places accessible for the public is provided.

During the reporting period, experts of Radon USC special combines participated in the mitigation of 17 radiation accidents including:

- Dnipropetrovsk SISP - 4;
- Kyiv SISP – 8;
- Lviv SISP – 2;
- Odesa SISP – 1;
- Kharkiv SISP – 2.

5.3. Legacy Radioactive Waste

Legacy radioactive waste in Ukraine includes the following:

- radioactive waste disposed in Soviet times at radwaste management facilities of Radon state interregional specialized plants;
- radwaste placed on the decontamination waste disposal sites and vehicle sanitary treatment sites (DWDS/VSTS), resulting from mitigation of the Chernobyl accident and located outside the exclusion zone in the Kyiv, Zhytomyr and Chernihiv regions;
- radwaste resulting from military programs of the former USSR.

Decontamination waste storage sites (DWDS) with topsoil, roofing materials, construction debris, etc., and vehicle sanitary treatment sites (VSTS) were constructed in settlements during accident mitigation at Chernobyl NPP in areas adjacent to the exclusion zone. In total, there are 53 DWDS/VSTS in Ukraine, six of them are VSTS.

The volume of contaminated materials in VSTS tanks is:

- 574 m³ of solid waste, and 295 m³ of liquid waste.

The tables provide information on decontamination waste (DW) contained at DWDS as of 01 January 2019.

Table 2. Summary data on DWDS in regions

Regions	Number of DWDS	DW volume, m ³	Activity, Bq
Zhytomyr	28	18720	2.68E+10
Kyiv	16	143708	5.07E+11
Chernihiv	3	9300	n.a.
Total	47	171728	5.34E+11

Table 3. Summary data on DWDS according to categories of radiation contaminated zones

Category of radiation contaminated zone	Number of DWDS	DW volume, m ³	Activity, Bq
Exclusion zone	8	141093	4.34E+11
Unconditional (mandatory) resettlement zone	21	15109	7.97E+10
Zone of guaranteed voluntary resettlement	18	15526	2.04E+10

The Kyiv SISP provides DWDS/VSTS maintenance, radiation monitoring and control. These facilities require additional inspection, safety assessment, making and implementation of decisions for their remediation.

The international technical assistance project for the remediation of Chornobyl waste storage sites beyond the exclusion zone is at the beginning of the practical implementation stage. These radioactive waste temporary storage sites were ranked according to their radiation hazard with financial support of the European Union under the “Instrument of Nuclear Safety Cooperation” Program.

Expert review and assessment of the documents for the implementation of Pisky-1 DWDS pilot project submitted by Radon USC was conducted with the involvement of international experts and SSTC NRS specialists (under INSC UK/TS/48 Project) in 2018. According to the review results, the measures and procedures for remediation of Pisky-1 DWDS meet the nuclear and radiation safety requirements.

Pisky-1 DWDS was constructed and filled in 1987–1989 as a result of decontamination activities in the neighboring villages (Pisky, Karpylivka, etc.), it is a trench with the maximum depth of ~ 1.8 m. According to survey results of Pisky-1 DWDS, disposed decontamination waste (DW) mainly consists of construction debris (roofing slabs and asbestos board) and contaminated soil.

Site remediation is expected in the future, in particular, retrieval of about 300 m³ of decontamination waste, its sorting and placement in packaging (bags), DW transport to Buryakivka RWDS for disposal, trench backfilling and DWDS territory remediation.

5.4. Chornobyl NPP Decommissioning

The only operating organization in Ukraine having a license to perform activities at the stage of nuclear installation decommissioning is Chornobyl Nuclear Power Plant (ChNPP).

Chornobyl Nuclear Power Plant is decommissioned by ChNPP in accordance with the license for nuclear facility decommissioning issued on 22 March 2002 (hereinafter the License).

The following is subject to decommissioning under the License:

- Units 1, 2, 3;
- temporary storage facilities for liquid and solid radioactive waste;
- other plant facilities.

ChNPP completed preparation for and started decommissioning of the ChNPP cooling pond and upon SNRIU's agreement in August 2016.

The SNRIU performed the state NRS review and approved conceptual and technical documents on the management procedure of radioactive equipment and materials at ChNPP upon ChNPP request under the development of an infrastructure for management of radioactive equipment and materials (REM) at ChNPP.

These documents justify ChNPP approaches and measures for temporary storage of radioactive equipment and materials in buildings and structures and in rooms of the buildings and structures that were emptied during ChNPP decommissioning.



SNRIU provided the state NRS review of these documents.

ChNPP submitted to the SNRIU an application for license renewal in November 2017. The need to renew the license is associated with special conditions established in the license to be fulfilled by ChNPP, namely:

- Chornobyl NPP operational termination stage was completed;
- individual permit No. OD 000040 was obtained for FCSS stage implementation;
- all spent nuclear fuel, including damaged one was removed from Units 1, 2, 3 to the interim spent fuel storage facility (ISF-1);
- measures on the heat supply system for ChNPP facilities were developed and implemented.

In 2018, the SNRIU continued review and assessment the document package submitted by ChNPP.

In the decommissioning process, a great volume of equipment and its components that are subject to release from regulatory control is dismantled.

With involvement of Riskaudit and SSTC NRS, the SNRIU conducts review of the design documents “Development of Facility for Release of Materials from Regulatory Control at ChNPP” submitted by ChNPP and developed under industrial project INSC U4.01/11E.

Radioactive Waste Management Facilities at Chornobyl NPP

Radioactive waste accumulated during Chornobyl NPP operation and accident mitigation in 1986 and generated during decommissioning of Units 1, 2 and 3 and Shelter transformation into an environmentally safe system is stored in radioactive waste storage facilities at the Chornobyl NPP site: solid radwaste storage facility, liquid radwaste storage facility, solid and liquid radwaste storage facility, or is transferred for disposal to Buryakivka RWDS disposal facilities.

In 2018, 0.60 m³ of liquid radwaste was generated at Chornobyl NPP and sent for temporary storage (filter perlite pulp). As of the end of 2018, 13 580.90 m³ of evaporation bottoms, 4 109.47 m³ of spent ion-exchange resins, 2 297.53 m³ of filter perlite pulp, and 145.31 m³ of contaminated oil-fuel mixture were accumulated in liquid radioactive waste storage facilities.

Low- and intermediate-level solid waste generated during decommissioning and Shelter transformation into an environmentally safe system was transferred to Buryakivka RWDS facilities for disposal. During 2018, 5 000.0 m³ (7055.59 t) of low-level radioactive waste was transferred to Buryakivka RWDS.

High-level waste is collected into special containers (KTZV-0.2) and placed into the interim storage facility for solid high-level waste arranged in the former fresh nuclear fuel storage building. During 2018, 0.1 m³ (0.03 t) of solid high-level waste was generated and transferred for storage.

A series of radioactive waste management facilities have been constructed and are being commissioned at the ChNPP site under international technical assistance projects. Commissioning of these facilities will allow processing of the accumulated and generated radwaste to bring it to the state acceptable for safe storage.

As part of the creation of the ChNPP radioactive waste management infrastructure, the SNRIU attracts ChNPP attention to the need to construct additional temporary storage facilities for radioactive waste at ChNPP site using rooms and buildings emptied during ChNPP decommissioning and accelerate the beginning of operation of radioactive waste treatment facilities at the ChNPP site.

Preparatory activities are currently under performance at ChNPP to start operation of the liquid radioactive waste treatment plant (LRTP) for treatment of liquid radwaste accumulated in tanks of liquid waste storage facility and liquid and solid waste storage facilities, as well as storage facilities for liquid radwaste to be generated in decommissioning.

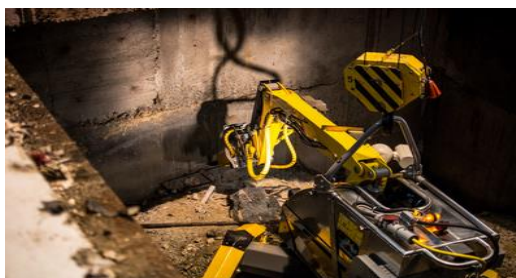
The technological process involves the treatment of liquid radioactive waste in the form of evaporation bottoms in evaporators, pulp of spent ion-exchange resins, perlite pulp and sludge.

On 23 March 2018, ChNPP obtained a certificate of the State Architectural and Construction Inspectorate of Ukraine, which confirmed the compliance of the constructed LRTP with the requirements of the construction standards.

In framework of LRTP operation activities, the SNRIU performed upon ChNPP request the state NRS review and approved the program and technical documents on “active” tests of LRTP for reprocessing of liquid radioactive waste, arrangement of temporary (buffer) storage site for radioactive waste packages, which are produced in LRTP, aging management, etc.

In 2018, liquid radwaste was not treated at LRTP, but equipment and systems were maintained in operable state.

Construction of the facilities of the industrial complex for solid radioactive waste management (ICSRM) has been completed, and they are being currently commissioned at ChNPP site.



Activities in ICSRM light compartments

ICSRM combines a series of radwaste management facilities (temporary storage facility for low- and intermediate-level long-lived and high-level waste is designed for intermediate (30 years) storage of long-lived and high-level waste to be generated in sorting at SRTP and during the construction of the Shelter New Safe Confinement. This storage facility was created by reconstruction and re-equipment of the room located at upper levels of the ChNPP liquid and solid storage which has not been in operation to date;

SRRF is a solid radioactive waste retrieval facility designed for retrieval of solid radwaste from the existing ChNPP solid waste storage and transfer of waste for treatment to SRTP;

SRTP is a solid radioactive waste treatment plant for sorting of solid radioactive waste of all categories and treatment (fragmentation, incineration, pressing, cementation) of low- and intermediate-level short-lived solid radioactive waste retrieved from the solid radwaste storage facility, and waste resulting from ChNPP decommissioning and Shelter transformation into an environmentally safe system.

SRTP also envisages packaging of long-lived and high-level waste that will result from sorting and transport of these packages to interim storage.

In the framework of ICSRМ commissioning, the SNRIU reviewed and agreed technical decisions on radiological characterization of HLW and low- and intermediate-level radiation sources under the activities on stage 2 of hot tests at ICSRМ, implementation of the method of radionuclide vectors for characterization of the radionuclide composition of radioactive waste packages at SRTP and technical specifications for operation of temporary storage of HLW and low- and intermediate-level radiation sources in the building of solid and liquid radwaste storage facility.

Harmonization of requirements of Ukrainian regulations on decommissioning with safety reference levels of the Western European Nuclear Regulators Association (WENRA)

Under the cooperation with the Western European Nuclear Regulators Association (WENRA), a self-assessment of the requirements of the Ukrainian regulations for compliance with the WENRA safety reference levels regarding radioactive waste storage was performed and submitted for consideration to the WENRA working group. The SNRIU participated in the meeting of the WENRA Working Group on Waste and Decommissioning (WGWD) and presented a self-assessment of the Ukrainian regulatory requirements for compliance with WENRA reference levels related to radioactive waste storage. The self-assessment was considered successful, some comments and remarks were made.

Taking into account the WENRA safety reference levels and the IAEA recommendations, the SNRIU continued in 2018 the development of regulations “General Safety Provisions for Decommissioning of Nuclear Facilities” and “Requirements for the Structure and Content of the Operator’s Documents Submitted to Obtain the License for Decommissioning of Nuclear Installations”.

5.5. Shelter Transformation into Environmentally Safe System

During 2018, the SNRIU implemented its priority activities such as safety assessment and licensing for the construction of the first startup package of the New Safe Confinement (NSC SP-1).

The Shelter is transformed into an environmentally safe system through subsequent development and implementation of individual plans, projects and programs.

One of the main Shelter projects is the construction of the New Safe Confinement (NSC).

The design lifetime of the NSC is 100 years.

The first startup package of the New Safe Confinement (NSC SP-1) is currently under implementation (construction of a protective structure with process life support systems and necessary infrastructure); the contractor for NSC design, construction and commissioning is French Novarka Consortium.

In November 2016, the NSC arch was moved into its design position above the Shelter.

Construction and installation under the NSC project was mainly completed in 2018. NSC internal and external areas were equipped (laying and thermal insulation of piping including external engineering network, arrangement of electric heating in piping, installation of the main systems in the process building and auxiliary buildings); the area between the NSC process building and deaerator stack was sealed; the activities have been performed related to pouring, puttying and painting the floors, walls and ceilings inside the process building and access gateway for fire brigades, as well as other activities were performed.

In the reporting year, pre-commissioning activities related to ventilation and fire systems, fire alarm, seismic and metrological control systems were under continuation, additional components in NSC main crane system were tested, etc.

Pursuant to the established procedures, ChNPP and Novarka Consortium performed acceptance tests of NSC systems and equipment.

After the completion of NSC fencing (the working design “Reconstruction of the Main Building of ChNPP Stage II (Units 3, 4) with Strengthening and Sealing of the Civil Structures Performing NSC Fencing Functions) and in accordance with the conditions of License EO No. 000033 for the Shelter Operation, ChNPP submitted in February 2018 an application and a package of documents for obtaining an individual permit for the operation of these structures after their strengthening and sealing.

Based on the state NRS review results of the revised Safety Assessment Report for this working draft and other documents submitted by ChNPP, as well as taking into account the inspection results, the SNRIU issued an individual permit for operation of the civil structures in NSC fencing in January 2019.



In order to assess safety in documents under the regulatory support of NSC SP-1 construction, SNRIU considered:

- revised parts of the project for the new safe confinement startup package 1 (NSC SP-1) related to:
 - evacuation routes for personnel from the maintenance garage of the main crane system (MCS) and upper elevations passing inside the annular space of the NSC arch;
 - ventilation of the annular space in the new safe confinement;
 - fire alarm systems and fire foam extinguishing systems on the roof in the turbine hall of the Shelter;

SNRIU also assessed the working designs of NSC fire protection and radiation monitoring of releases, ChNPP decisions on the ventilation mode in the combined Shelter/NSC system for the period of ventilation system testing, changes in the steel grade to produce liquid radioactive waste tanks, operating documents and technical specifications for NSC systems and equipment, as well as other documents.

The activities are performed at the Shelter under the license establishing the scope and conditions of the authorized activities to transform the Shelter into an environmentally safe system. The license is valid until the commissioning of the New Safe Confinement of the Shelter (NSC).

The nuclear and radiation safety of the Shelter is ensured by a system of administrative and technical measures during current operation of the facility and in implementing the

projects for its transformation into an environmentally safe system.

The nuclear and radiation safety of the Shelter is assessed based on the results of routine measurements of parameters characterizing fuel-containing materials, radiation situation at the work sites and in the adjacent territory, activity of contaminated water of the Shelter. Releases from the facility into the atmosphere and effluents into hydrogeological environment, the condition of the civil structures of the Shelter are also subject to control.

Radiation and dosimetric monitoring is provided during the activities at the Shelter, and the dose loads of personnel of ChNPP and contracting organizations are recorded.

According to ChNPP, in 2018 the average individual dose of ChNPP personnel who worked at the Shelter or visited the local zone and rooms in the facility made up 1.44 mSv and decreased by 11.5% compared to the previous year 2017. The average level of individual doses of contractor personnel was 3.08 mSv, which is approximately 76.42% compared with 2017.

No exceeded reference levels of individual annual exposure doses to ChNPP and contractor's personnel were recorded. The external exposure reference level for ChNPP and contractor's personnel is 13 mSv/year.

Solid and liquid radioactive waste is generated during the activities at the Shelter and in the adjacent territory.

The main solid radioactive waste is soil, scrap metal, mixed construction debris; secondary waste includes used individual protective means and decontamination waste.

During the reporting period, ChNPP and contractors removed in total 219.7 m³ (172.35 t) of solid radioactive waste with total activity of 1.14×10^{10} Bq from the Shelter territory to Buryakivka RWDS, which is significantly less than in 2017. The main cause for the decrease in the amount of generated solid radioactive waste is the completion of the main construction activities under NSC.

The generation sources of liquid radioactive waste (radioactive water) are decontamination of rooms, equipment and tools, dust suppression, changing room operation.

During 2018, 541 m³ of radioactive water with total activity of $7.912 \cdot 10^9$ Bq were collected and pumped from the Shelter rooms to prevent radioactive substance release into the groundwater and improve the radiation situation. The total volume of pumped water decreased by 37.96% compared with 2017, which can be related to the exclusion of precipitation flow into the Shelter resulting from installation of the NSC arch in its design position.

In November 2018, ChNPP scheduled inspection was conducted under the oversight activities, which confirmed following of the safety requirements by the operating organization during its activities at the site and during NSC SP-1 project implementation.

6. PHYSICAL PROTECTION

6.1. Measures to Improve Effectiveness of State Physical Protection System

An important area in the use of nuclear energy in Ukraine where nuclear energy infrastructure is highly developed is the physical protection of nuclear installations and radioactive materials.

2018 was the anniversary year for the physical protection. The events that have started and set the tasks and areas for physical protection development in our country occurred 25 years ago in 1993. The physical protection has reached significant development during this period.

The challenges in providing security of nuclear installations and radioactive materials attracted considerable attention of the public and a wide range of experts last years. This is caused not only by an increasing threat of sabotage, but also by a significant increase in the awareness of these threats at the highest state political level.

In this regard, the priorities of the state policy in the field of nuclear energy in terms of security are aimed at fulfilling Ukraine's international obligations to achieve the main physical protection goals: minimizing the risks of sabotage, theft or any other unlawful withdrawal of radioactive materials and strengthening the regime of nuclear weapon non-proliferation.

The SNRIU brought the state physical protection system to increased readiness since January 2014 according to Cabinet Resolution "On Approval of the Procedure for the Functioning of the State Physical Protection System" No. 1337 of 21 December 2011. Certainly, this was facilitated by the events in Ukraine and the complex socio-political situation, which required additional measures to maintain the physical protection regime.

The physical protection measures were arranged and taken in 2018 under real threats caused by the aggression of the Russian Federation in the east of the country, sabotage acts of the "LPR" and "DPR" combatants and a significant escalation of the socio-political situation in the state.

Command-staff and tactical exercises were conducted at all NPPs to verify the effectiveness of the facility-level interaction plans in the event of sabotage, during which measures were taken to counter-sabotage and antiterrorist protection of NPPs. Plans are being implemented to form, develop and maintain a high level of security culture.

In addition, special tactical exercises were initiated under the interaction plans in case of sabotage at the enterprises using I-II category radiation sources involving all plan participants and SNRIU experts. Such exercises should be conducted in all medical institutions that use such radiation sources. An urgent need to conduct exercises arose resulting from the analysis of information received at the Central Monitoring Station established in SNRIU under the Global Threat Reduction Initiative (GTRI) program to enhance security of radiation sources in Ukraine under the auspices of the U.S. Department of Energy.

SNRIU inspectors conducted scheduled inspections of the physical protection systems at all NPPs as part of the oversight activities.

In addition, inspections were conducted to check compliance with the requirements for the physical protection of two enterprises in the exclusion zone: Chornobyl NPP and the State Specialized Enterprise "Central Enterprise for Radioactive Waste Management", as well as two enterprises in the territory of the former Prydniprovsky Chemical Plant: State Enterprise "Barrier" and State Enterprise "VITCh-38".

SNRIU Physical Protection experts constantly amended the Interaction Plans in Case of Sabotage, Physical Protection Plans, Physical Protection Level Records, Lists of Employee positions requiring admission to the implementation of special activities, and the object design threats were considered and agreed in order to prevent a threat of sabotage, theft and other illegal actions of internal offenders.

A package of documents was drawn up for 41 SNRIU experts and regional inspections to conduct special inspection, and admission to special activities was provided for 44 persons.

6.2. Project to Enhance Security of Radiation Sources

The engineering features of the physical protection systems in cancer treatment centers and in the installations using high-level radiation sources and radwaste disposal sites in Ukraine were modernized under the project “Enhancing Security of Radiation Sources”; - activities were performed to consider drawbacks in the operation of the communication systems (data transmission lines), they were operated in a testing mode.

A working meeting between experts of the Radiation Safety Administration of the U.S. Department of Energy and representatives of the management of the Security Police Department of the Ministry of Interior of Ukraine was held with the participation of SNRIU experts in February 2018. The meeting was aimed at discussing the ways to improve efficient response of the external assistance forces to warning signals generated by the physical protection systems of category I radiation sources and the personnel training program in the educational institutions of the security police.

The next steps for implementing the program to enhance security of radioactive materials and the program to improve efficiency of physical protection of radioactive waste, radiation sources at the State Enterprise “UDVP Isotope” were discussed at the working meeting of experts of the Radiation Safety Administration of the U.S. Department of Energy and SNRIU experts. The possibility of providing special transport for transfer of high-level radiation sources, its equipping with engineered features, as well as establishing a transport monitoring station was discussed at the meeting with the management of the State Enterprise “UDVP Isotope” in Kyiv.

Training course for response to warning signals on unauthorized intervention to radiation sources used in Ukraine was held. The training course included tactical and special exercises for participants of the Interaction Plan in case of sabotage, which were held in the Podilsk Regional Oncology Center, and a workshop in the Vinnytsia vocational school of the Security Police Department with the involvement of representatives of vocational school, response forces and relevant medical personnel.

6.3. Detection of Radioactive Materials in Illicit Trafficking

26 informational notifications on the cases of revealed illicit trafficking of radioactive materials in Ukraine were sent within the information exchange with the IAEA database on incidents and illicit trafficking of nuclear and other radioactive materials (ITDB) in 2018.

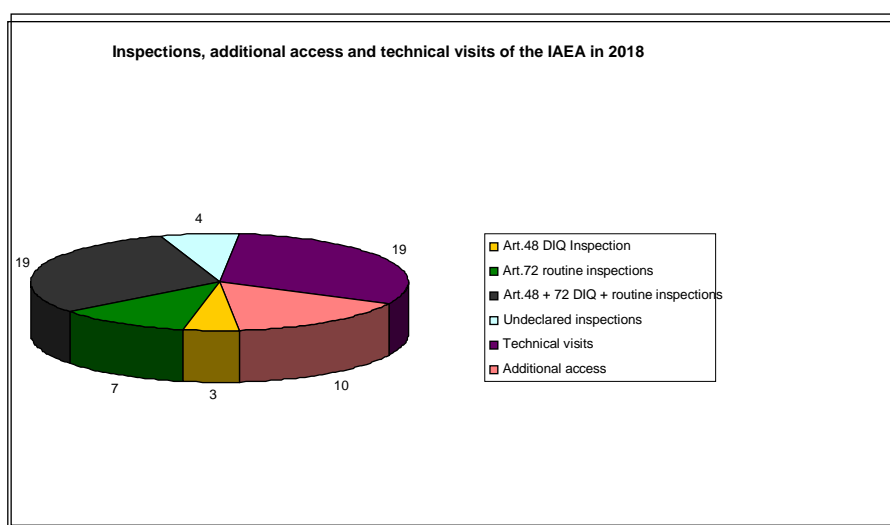
On 05-07 June 2018, with the support of the IAEA, a workshop was held on the procedure for collecting and submitting data to the IAEA database for representatives of the central executive bodies of Ukraine.

On 19-22 November 2018, a technical visit to Georgia was held to learn about the experience in arranging the national structure to counteract radiation, chemical, biological and nuclear (RCBN) challenges and threats.

On 17-19 September 2018, we took part in the Ukrainian-Polish exercises to work out the scenarios of revealing illicit trafficking of nuclear and radioactive materials under the joint project with the U.S. Department of Energy on the International Technical Assistance “Revealing and Prevention of Illicit Trafficking of Nuclear and Radioactive Materials” that were held at Rava-Ruska border crossing point of Ukraine in Lviv oblast.

On 16 -19 October 2018 we took part in the joint cross-border exercises in Odessa to prevent attempts of illicit trafficking of radioactive materials in the common area of the border beyond the state border checkpoints and in the workshop on improving the information feedback and methods of response to the presence of radioactive materials beyond regulatory control. The event was held under the implementation of the Program on export control and border security of the U.S. Embassy in Ukraine.

6.4. Nuclear Weapon Nonproliferation Safeguards



In 2018, Ukraine carefully fulfilled the obligations under the international agreements according to the Treaty on the Non-Proliferation of Nuclear Weapons. The assessment of this is receiving from the IAEA a broader conclusion for the reporting period. This means that no undeclared nuclear activity has been revealed in Ukraine and all nuclear materials are used for peaceful purposes. To provide such a conclusion, the IAEA inspectors conducted a number of inspections that were sent to verify the Design Information documents of existing installations and those under construction. The so-called routine and undeclared inspections were conducted to confirm the absence of undeclared nuclear activity and the declared inventory of nuclear materials. In addition, the IAEA inspectors and technical staff arranged technical visits. Installation/replacement/adjustment of remote monitoring equipment was usually performed during such visits.

In addition, the required information and reports were submitted the IAEA within the deadlines and in the format in accordance with the Agreement and the Supplementary Provisions to the Agreement, namely: the reports of entities using nuclear materials and previous reports on international transfer of nuclear materials, information for planning of the IAEA inspections, updated documents on the design information.

In 2018, a system for information transfer to the IAEA through the safeguards state declaration portal was introduced as a safe and fast method for exchange of information (declarations and reports) between SNRIU and the IAEA.

To implement the Additional Protocol to the Agreement between Ukraine and the IAEA on the application of safeguards according to the Treaty on the Non-Proliferation of Nuclear

Weapons, the information was submitted to the IAEA on a quarterly basis on export supplies of agreed equipment and non-nuclear material from Ukraine; an annual information update was conducted under the Additional Protocol to the Agreement; ten additional admissions of the IAEA were arranged at Ukrainian enterprises with the participation of SNRIU state inspectors.

As in previous years, the activities related to the compliance with the requirements of the Safeguards Agreement and the Supplementary Protocol are analyzed during the meetings



of the joint Ukraine-IAEA High-Level Working Group on the consideration of safeguards application in Ukraine. The last meeting was held on 12-13 June 2018 in SNRIU. Representatives of the IAEA headed by IAEA Director, Division of Operations C, Mr. Haroldo Barroso Junior, SNRIU, Ministry of Fuel and Energy, Ministry of Foreign Affairs, SAEZ, Energoatom, NSC KIPT took part in it. The key issues on the implementation of the Safeguards Agreement and the

Supplementary Protocol to the Safeguards Agreement were discussed at the meeting. In addition, a working meeting between SNRIU Chairman and the IAEA Director of Operations C Division was held during the 62nd session of the General Conference to discuss safeguards applied at Ukrainian installations.



On 18 September 2018, the Administrative Agreement between the State Nuclear Regulatory Inspectorate of Ukraine and the Australian Bureau of Safeguards and Non-Proliferation was signed in accordance with the Agreement between the Government of Ukraine and the Australian Government on cooperation in the field of peaceful nuclear energy use that envisages the procedures of information exchange on the accounting of nuclear materials, which are subject to this Agreement.

A training workshop on the topic “Obligations of operators in the layout points beyond the installations to implement IAEA safeguards” under the international program to support nuclear weapon non-proliferation safeguards was arranged and conducted in Kyiv on 8-12 October 2018.

The next International Symposium on Nuclear Weapon Non-Proliferation Safeguards took place in Vienna in November 2018. This world’s largest nonproliferation forum is held every four years. Ukraine presented at the symposium a report on the SNRIU information system from the Supplementary Protocol.

7. INTERNATIONAL ACTIVITIES

SNRIU international cooperation is an integral part of developing the national regulation system for nuclear and radiation safety and is aimed at achieving the world nuclear and radiation safety standards in Ukraine.

An important place among the diversity of international cooperation areas is taken by multilateral conventional mechanisms and instruments joined by Ukraine, including membership in international organizations and associations.

The SNRIU also ensures implementation of a number of intergovernmental and interagency international agreements in nuclear and radiation safety regulation both with leading countries, which operate nuclear power plants and with countries that are only launch implementing nuclear power programs. During many years of the Ukrainian regulatory body's activities, stable partnering relationships with the regulatory authorities of the United States, Germany, France, Finland, Sweden, Norway, etc. were established.

7.1. Cooperation with European Institutions



With signing the Association Agreement in 2014, cooperation with the EU and its bodies and institutions has become a priority in the SNRIU international activities. During 2018, the implementation of two projects of the **European Commission** under the INSC (Instrument for Nuclear Safety Cooperation) program was continued:

- Safe radioactive waste management at Vektor industrial site in the Chernobyl exclusion zone, support for licensing of new nuclear subcritical facility - neutron source based on an electron accelerator-driven subcritical assembly, and oversight and assessment of nuclear and radiation safety in terms of the licensee management system and human factor” (U3.01/12 (UK/TS/48-50).

- Strengthening the State Nuclear Regulatory Inspectorate of Ukraine capabilities for regulation of nuclear activities, nuclear installation licensing and severe accident analysis (U3.01/14-15 (UK/TS/51-57).

In 2018, experts from the SNRIU and State Scientific and Technical Center for Nuclear and Radiation Safety (SSTC NRS) took an active part in implementing the European Commission project for the Republic of Belarus in terms of providing support and assistance in strengthening Belarusian regulatory authority capabilities in the area of licensing and oversight during construction of a nuclear power plant.

In 2018, the SNRIU continued active cooperation with the **Western European Regulators Association (WENRA)** as a full member since 26 March 2015. The activities were continued in three WENRA working groups: Reactor Harmonization Working Group (RHWG), Working Group on Waste and Decommissioning (WGWD), Working Group on Reference Levels for Research Reactors (WGRR).



The SNRIU organized the scheduled meeting of the Reactor Harmonization Working Group (RHWG), which was held on 5-8 June 2018 in Kyiv and the meeting of the Working Group on Reference Levels for Research Reactors (WGRR), which was held on 18-19 April in Kyiv.



In 2018, the SNRIU continued active interaction with the **European Nuclear Safety Regulators Group (ENSREG)** in the context of participation in the First Thematic Review on aging management to comply with EU Directive 2014/87EURATOM. On 14-18 May 2018 (Luxembourg, the Grand Duchy of Luxembourg), the Ukrainian delegation including representatives of the State Nuclear Regulatory Inspectorate, State Scientific and Technical Center for Nuclear and Radiation Safety and Energoatom participated in a workshop to

discuss the results of the first topical peer review of the National Reports on Aging Management of the EU, Norway, Switzerland and Ukraine. At the end of September 2018, the ENSREG Council approved the general final report on the results of the partner review and sent it to the participating countries for consideration and further implementation of the recommendations for improvement.

During the year, two Grant Agreements with **the European Bank for Reconstruction and Development (EBRD)** were implemented: Grant Agreement (Chornobyl NPP Nuclear Safety Project) between the European Bank for Reconstruction and Development (as an Administrator of Grant funds from the Nuclear Security Account), the Cabinet of Ministers of Ukraine and the State Nuclear Regulatory Inspectorate of Ukraine (as a Recipient), which was signed on 8 July 2009 and ratified by the Law of Ukraine No. 1813-VI of 20 January 2010 and Grant Agreement “Shelter Chornobyl Fund: Licensing Consultant”, which was concluded on 11 May 1998 between the EBRD as an Administrator of grant funds provided from the Chornobyl Shelter Fund and the Nuclear Regulatory Administration of the Ministry of Environmental Protection and Nuclear Safety of Ukraine.

7.2. Compliance with Obligations under International Conventions

From 21 May to 1 June 2018, the Sixth Meeting of the Parties to Review the **Compliance with the Joint Convention** on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (hereinafter - the Joint Convention) was held in the IAEA headquarters in Vienna, in which the Ukrainian delegation took part.

The Sixth National Report of Ukraine on compliance with the obligations under the Joint Convention was presented on 23 May 2018, according to the agenda. The Sixth National Report was developed in full compliance with the requirements of the Joint Convention and



Guidelines on the Form and Structure of National Reports INFCIRC/604/Rev.3 supplemented, as well as taking into account the recommendations of the Final Report of the Fifth Meeting of the Parties. During the review, 82 written questions on the National Report of Ukraine from 19 Contracting Parties of the Convention were received. This indicates high interest of the Parties to

Ukraine. Comprehensive answers were provided to all written questions of the Parties.

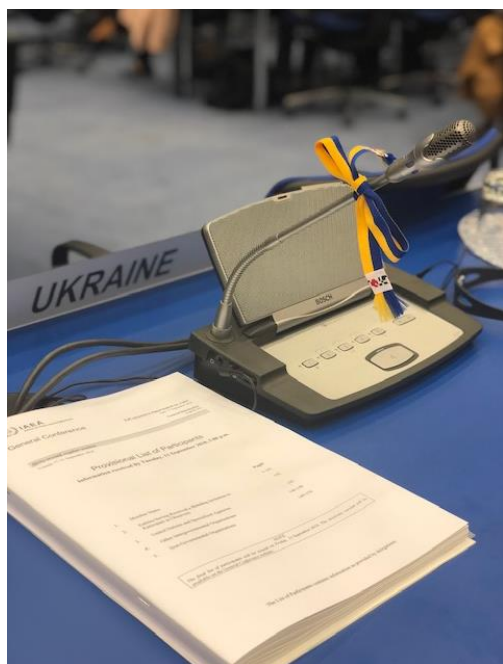
7.3. Participation in Programs and Projects of the International Atomic Energy Agency

Four national projects of the IAEA Technical Cooperation Program for 2018-2019 were implemented in 2018.

On 14-17 May 2018, the SNRIU organized a regional IAEA workshop “Communication for Safety”

During the year, SNRIU implemented the Integrated Nuclear Security Support Plan (INSSP) for Ukraine.

In 2018, Ukrainian experts made a significant contribution to the improvement of



IAEA safety standards by active work within the Nuclear Safety Standards Committee (NUSSC), Radiation Safety Standards Committee (RASSC), Waste Safety Standards Committee (WASSC) and Nuclear Security Guidance Committee (NSGC).

During the year, SNRIU provided active interaction and information exchange with the IAEA Illicit Trafficking Database (ITDB).

In 2018, a system of the Ukrainian Profile of the IAEA Radiation Safety Information Management System (RASIMS) and the National Nuclear Safety Research Group (NNSRG) was updated.

An SNRIU representative actively participated in the work of the Standing Advisory Group on Safeguards Implementation (SAGSI) under the IAEA Director General.

On 17-21 September 2018, SNRIU Chairman headed the Ukrainian delegation to participate in the 62nd session of the IAEA General Conference held in Vienna, Austria. During the General Conference, the member countries worked out the IAEA annual report for 2017, issues of contributions to the Technical Cooperation Fund for 2019, renewal of IAEA budget for 2019, issues of strengthening international cooperation in nuclear safety, radiation safety, transport safety and waste safety, issues of security, strengthening IAEA activities in technical cooperation, activities related to nuclear science and technologies, enhancing efficiency of IAEA safeguards, use of agency safeguards in the Middle East, as well as elections to the IAEA Board of Governors, etc.

Within the General Conference, SNRIU Chairman H. Plachkov held working meetings with Chairman of the Hungarian Atomic Energy Authority G. Fichtinger, Chairman of the Polish National Atomic Energy Agency Andrzej Przybycin, high officials of the delegation from the United States of America, European Commission, etc. Within the participation in the 62nd session of the General Conference, the following was signed:



- **Memorandum** on Scientific and Technical Cooperation in Nuclear Safety between the State Nuclear Regulatory Inspectorate of Ukraine and its technical support organization State Scientific and Technical Center for Nuclear and Radiation Safety and the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety of **the Federal Republic of Germany** and its technical support organization Association for Safety of Installations and Reactors (**GRS**).

- **Administrative Arrangement**

between the State Nuclear Regulatory Inspectorate of Ukraine and the Australian Safeguards and Non-Proliferation Office in accordance with the Agreement between the Government of Ukraine and the Government of Australia for Cooperation in the Peaceful Uses of Nuclear Energy. The Agreement establishes procedures for submission of reporting documents on nuclear material transfer and with its signing, provides legal framework to conclude contracts for supply of uranium concentrate to Ukraine.

From 19 to 20 June 2018, the 25th Annual Forum of regulatory authorities of the countries operating WWER (**WWER Forum**) was held in Ostrovets (Republic of Belarus). During the meeting, heads of regulatory authorities presented national reports on the development of regulatory infrastructure and relevant issues on nuclear and radiation safety since the last meeting of the WWER Forum (2-4 May 2017, Isfahan, Islamic Republic of Iran). The working groups of the WWER Forum reported on the activities in 2017-2018.

7.4. Bilateral Cooperation Programs

During 2018, SNRIU jointly with the SSTC NRS and the **Norwegian Radiation Protection Agency (NRPA)** implemented 7 cooperation projects. In 2018, the implementation of three new cooperation projects has started. On 23 October 2018, the “Protocol on Amending the Agreement between the State Nuclear Regulatory Inspectorate of Ukraine and the Norwegian Radiation Protection Agency on Cooperation Nuclear and Radiation Safety” was signed to update the legal and contractual framework of bilateral cooperation in nuclear and radiation safety.

During 2018, SNRIU provided active cooperation in nuclear and radiation safety with the **Swedish Radiation Safety Authority (SSM)** under the Agreement between the State Nuclear Regulatory



in

Inspectorate of Ukraine and the Swedish Radiation Safety Authority on Cooperation in Nuclear and Radiation Safety.

Implementation of the following projects were provided:

- Information support of the State Nuclear Regulatory Inspectorate of Ukraine, development and filling of an independent web resource on nuclear safety, radiation protection and non-proliferation of nuclear weapons: www.Uatom.org.
- modernization of applied software of the information system of the State Register of Radiation Sources.
- Technical support of SNRIU to maintain the database on nuclear material accounting (STAR).

In 2018, active cooperation with the United States of America was implemented. On 13 March 2018, an agreement between the State Nuclear Regulatory Inspectorate of Ukraine and the **United States Nuclear Regulatory Commission** on technical information exchange

and cooperation in nuclear safety was signed in Rockville,



On 2-5 October 2018, the State Nuclear Regulatory Inspectorate of Ukraine hosted the delegation from the U.S. Nuclear Regulatory Commission headed by Commissioner Stephen Burns. The visit took place at the invitation of SNRIU Chairman Hryhorii Plachkov, which was announced during his visit to the United States on 12-16 March 2018. The purpose of the visit was to exchange experience in nuclear and radiation safety regulation, discuss the status and prospects of bilateral cooperation.

On 29-30 October 2018, the U.S. delegation, consisting of representatives of the U.S. Nuclear Regulatory Commission and the Brookhaven National Laboratory (BNL), visited SNRIU and SSTC NRS with a working visit to discuss the status of implementing the Memorandum of the meeting between SNRIU and the U.S. Nuclear Regulatory Commission for 2016- 2017 and proposals for its update.

As part of the cooperation with the **U.S. Nuclear Regulatory Commission**, the provisions of the agreements on computer codes CAMP and CSARP were implemented.

In response to the project proposals submitted by SNRIU in 2018 within the Global Partnership Initiative, the implementation of two projects on interdepartmental staff exercises for response to emergencies and acts of nuclear terrorism and on modernization of the SNRIU

Emergency and Information Center were continued under the **U.S. Department of Defense Threat Reduction Program**.



In 2018, the stage of implementation start was initiated for the following projects on cooperation with the U.S. Department of State: “Strengthening the Information Security of the



SNRIU and Radiation Sources” and “Assessment of Radioactive Source State”.

In 2018, the cooperation with the **U.S. Department of Energy** continued under the Executive Arrangement between the State Nuclear Regulatory Inspectorate of Ukraine and the United States Department of Energy on the cooperation for safety improvement of radiation sources used in Ukraine since 23 June 2006. Project “Safety Improvement of Radiation Sources Used in Ukraine” was implemented for increasing the Ukraine's capabilities to prevent the unauthorized use of radiation sources that could pose risk to the public in case of their use with a criminal intent.

List of Abbreviations

C(I)SIP	–	Comprehensive (Integrated) Safety Improvement Program for Nuclear Power Plants
ChNPP	–	Chornobyl Nuclear Power Plant
CRME	–	Centralized Radioactive Waste Management Enterprise
CSFSF	–	Centralized Spent Fuel Storage Facility
IAEA	–	International Atomic Energy Agency
ICSRM	–	Industrial Complex for Solid Radioactive Waste Management
INES	–	International Nuclear and Radiological Event Scale
ISF	–	Interim Spent Fuel Storage Facility
KhNPP	–	Khmelnitsky Nuclear Power Plant
LRTP	–	Liquid Radioactive Waste Treatment Plant
NPP	–	Nuclear Power Plant
NRS	–	Nuclear and Radiation Safety
NSC	–	New Safe Confinement
Radwaste	–	Radioactive Waste
RNPP	–	Rivne Nuclear Power Plant
RWDS	–	Radioactive Waste Disposal Site
SISP	–	State Interregional Specialized Plant
SP	–	Startup Package
SUNPP	–	South Ukraine Nuclear Power Plant
WWER	–	Water-Cooled Water-Moderated Power Reactor
ZNPP	–	Zaporizhzhya Nuclear Power Plant